

FEBRUARY 6, 1956

50 Cents

AVIATION WEEK

A MCGRAW-HILL
PUBLICATION



Britain's Air Dilemma:
Too Little and Too Late

Flying Boom or Probe-Drogue
Refuels McDonnell's F-101A

what does lowest height mean in a nut?

SPACE SAVINGS!
WEIGHT SAVINGS!



OLD STYLE
Regular Height
Tension Nut (AN366)

KAYLOCK
all-metal self-locking nuts
Shear-nut height with
tensile nut strength

As the lowest flange, smallest, lightest and strongest of all self-locking nuts — Kaylock's versatility will meet all of your structural fastener requirements.

Kaylock nuts are precision product produced in full conformance with Air Force/Military specifications AN-363 and AN-365. For more information, write for our catalog.



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Going
up
with

- vertical stabilizer
- rudder
- horizontal stabilizer
- wing leading edge and slats

built
by

GOODYEAR AIRCRAFT

North American Aviation sets exacting standards for its high performance F-100 Super Sabre. Goodyear Aircraft Corporation, at its Akron plants, has contributed its metal-working skills to deliver quality assemblies, on time, on specs, and at the right price. Another demonstration of the versatility and quality performance of Goodyear Aircraft Corporation. Plants in Akron, Ohio, and Litchfield Park, Arizona.

Twin-jet raider is Navy's largest carrier-based bomber

A positive step is accelerating an enemy sea force is to weaken or immobilize base ports and trading bases. This strategy, to be successful, has always demanded a huge force.

Now the Navy has a new weapon, a versatile jet bomber—the Douglas A3D Skywarrior—a fast, high-altitude raider with a nuclear warhead that could smash harbor installations, submarine pens or coast line defenses in a single blow.

Skywarrior is not only the largest carrier-based bomber, but is faster than many fighters, and designed to handle a wide variety of missions.



Defense Is Everybody's Business

Development of the A3D shows how Douglas works with the Navy in its long-range programs. But without war and science to fly and service them, the Navy's airplanes are useless. If you agree that defense is everybody's business, give a thought to a career with the U. S. Navy.



Depend on **DOUGLAS**



First in Aviation

AVIATION CALENDAR

- Feb. 14-15—Yankee Canoe Conference, Cawston, Ontario, Canada. Sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Univ. of Pa.
- Feb. 22-24—AWEA annual, Ohio Institute of Aeronautical Engineers, Ohio Univ., Ohio State University Campus.
- Mar. 6-8—Fourth Annual Air Lin. Pilot Association, Air Safety Forum, Mendenhall Hotel, Chicago.
- Mar. 14-16—1956 Section D Conference of the American Society of Mechanical Engineers, Sheraton Hilton Hotel, Los Angeles, Calif.
- Mar. 19-21—Society of Automotive Engineers, national production meeting and business Round Table, Cleveland, Ohio.
- Mar. 19-22—Institute of Radio Engineers, national convention, Waldorf Astoria Hotel & Knickerbocker, New York.
- Apr. 9-12—Society of Automotive Engineers, national aerospace meeting, aerospace production forum and aircraft engineering, Dayton Hotel, Dayton, Ohio.
- Apr. 10-11—Symposium for Management an Application of Aeronautics, sponsored by American Society of Mechanical Engineers, University of Kansas City, Kansas City, Mo.
- Apr. 16-19—First Annual National Industrial Research Conference, sponsored by American Research Foundation, Hotel Sheraton, Chicago.
- Apr. 19-20—Second Annual Meeting of the Section, Section of the Environmental Engineering Institute, Sheraton Hotel, Chicago.
- Apr. 23-26—American Association of Airport Executives, 25th annual convention, Hotel Carter, Cleveland, Ohio.
- May 2-6—Fourth of International Weight Engineers, 14th annual conference, Fort Worth, Tex.
- May 25—Twelfth Annual National Forum of the American Helicopter Society, Sheraton Park Hotel, Wichita, D. C.
- May 3-4—South Atlantic Institute of Aeronautical Sciences, West Coast Chapter Conference, Los Angeles.
- May 7—North Technical Conference of the International Air Transport Association, San Francisco.

AVIATION WEEK • FEBRUARY 6, 1956
Vol. 45, No. 4

Published weekly, except an additional issue in January, by the AVIATION WEEK PUBLISHING CO., Inc., 1000 Broadway, New York 10, N. Y. Telephone: MU 2-1100. Second-class postage paid at New York, N. Y., and at additional mailing offices. Postmaster: Send address changes in New York City to AVIATION WEEK, 1000 Broadway, New York 10, N. Y. Outside New York City to AVIATION WEEK, P.O. Box 518, Hightstown, N. J. 08520. Single copies 50¢. Subscriptions: One year (12 issues) \$5.00 in advance. Two years \$9.00. Three years \$12.00. All payments in advance. Payment by check or money order preferred. Claims for missing issues will only be considered if made immediately on receipt of following issue. Entered as Second-Class Matter, Postpaid.

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CLOSE TOLERANCE STEEL CASTINGS AT LOW COST

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 - ✓ **TOLERANCES** as close as $\pm .001"$ to $.005"$ per inch
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 - ✓ **LOWER PRODUCTION COSTS** Adding wood or metal patterns can be used. Design changes quick and inexpensive.
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 - ✓ **SHORT LEAD TIME**

ADAPTABLE TO MANY CASTING SIZES AND ALLOYS—casting weights up to one hundred pounds or more. Carbon steel, nonferrous, low alloy, stainless steels and the superalloys.

SEND US YOUR BLUEPRINTS Our sales engineering department will show you how the revolutionary Lebanon CERAMICAST Process can be adapted to your present design.

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45 LEBANON STREET LEBANON, PENNSYLVANIA
CARBON, LOW ALLOY AND STAINLESS STEEL CASTINGS



From blueprint to welded

component



WELDING



FABRICATING



MACHINING



Let American Welding handle the job!

The next time design requires a circular weldment, or you think fabrication of a complicated weldment might be the best solution, give us a call. Our Industrial Products Division stands ready to assist manufacturers with problems involving fusion or resistance welding of all types of metals. In addition, we are actually a complete manufacturing plant with the "know-how," the manpower, and the facilities to handle the operations required to produce finished welded components of complex design or assembly. Send today for our new 26-page catalog describing American Welding facilities that are available. Let us demonstrate what American Welding can do for you.

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THE AMERICAN WELDING & MANUFACTURING CO.
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New! AC speed sensing control



...for jet engines



...for turboprop engines

- accurate within 1/2 of 1% of operating speed settings
- no attention required between engine overhauls
- meets all requirements of MIL-2-5209A

- 1 Through Drive Shaft
- 2 Standard A/N Drive Pulley or both ends
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The most sensitive control of its kind yet produced for use on gas turbine engines!

Now, you can automatically control ignition at set engine speeds - ... control fuel flow - ... operate hydraulic bleed valves - ... control shutters - ... or any of a dozen other operations important to the functioning of a gas turbine engine.

But, the amazing part is this: This new AC Speed Sensing Control is completely ruggedized, and is precision built, that it will "expect" within a tolerance of less than 1/2 of 1%.

What's more, this small-size, lightweight control will operate switches at as many as four different predetermined speeds. It is designed to withstand high engine vibration, is ignition-proof, will hold calibration and operate without adjustment for periods exceeding engine overhauls.

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THE ELECTRONIC DIVISION OF GENERAL MOTORS • FLOID MCGRAW • MILWAUKEE, WISCONSIN

BUNGEE CONTROL SYSTEMS

R-460-Rotary

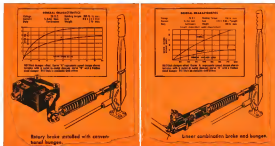
(variable torque)

R-590-Linear

(variable torque)

350 lb. max. brake holding capacity.

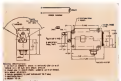
450 lb. max. brake holding capacity.



These units are available in other configurations to meet specific torque and steady state speed requirements.

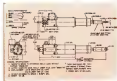
MAGNETIC BRAKE, most desirable for control applications in many large cranes. It has most brake capacity successfully to load most cranes. This unit designed as a variable torque at low lb. max. capacity used in several other

crane types for the bungee control. In use, the brake is normally open and is engaged to remove unwanted load for these wheels. These units are available in either rotary or linear configurations and with or without bungee spring.



Special design features are available to meet specific requirements:

- Springing for load shock or vibration resistance
- Wide range of torque and speed ratings
- Limited value of torque (range from 10 to 100)
- Limited value of torque (range from 10 to 100)



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Only in LAMINUM® can you get the unique qualities of stainless steel combined with the advantages of surface-bonded laminated shims.

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SHIM HEADQUARTERS SINCE 1913

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the impossible took a little longer...

but **AMP** found the solution for
aluminum wire termination

No galvanic action... oxidation is inhibited... full rated conductivity is assured... by using AMP's all aluminum Termalum Terminals. The distinguishing features are the cartridge, containing a moisture inhibitor compound, and the specially-designed symmetrical "C" wing. Under pressure of the crimp the compound extrudes oxide from the wire and prevents it from reforming. The cartridge is closed with a removable plastic plug that is color-coded for wire size identification. The entire terminal is top-placed by a special process to assure high conductivity and corrosion resistance.

TERMALUM

Trade name

terminals and connectors

Copeland Terminals and Connectors have the same features as Termalum except that the body tongue is made of copper. With this design, smaller tongues are permissible. Precautions usually taken with aluminum terminals when connecting to copper buses can be eliminated. Termalum and Copeland Terminals and Connectors exceed all military specifications.

AMP Termalum and Copeland Terminals are applied with AMP Dyna-Crimp® Power Tools and Hand- or Foot-operated Hydraulic Tools. Dyna-Crimp Tooling is available for bench mounting or with a portable cart.

Write for additional information on these products.



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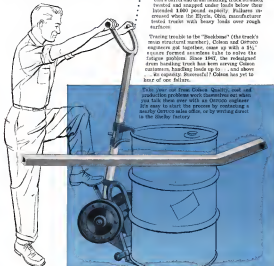
Coleman cures
barrel-truck fatigue with

STRONGER BACKBONE FROM OSTUCO

First experimental models of Coleman Corporation's barrel and drum handling truck strengthened and snapped under loads below those intended 1800 pound capacity. Failures increased when the Ellyria, Ohio, manufacturer tested trucks with heavy loads over rough surfaces.

Tracing trouble to the "backbone" (the truck's main structural member), Coleman and Ostuco engineers put together, piece by piece, a 15 1/2" square formed seamless tube to solve the fatigue problem. Since 1945, the redesigned drum handling truck has been serving Coleman customers, handling loads up to... and above... its capacity. Successful? Coleman has yet to hear of one failure.

Take your cue from Coleman. Quality, cost, and production problems work themselves out when you take these over with an Ostuco engineer. It's easy to start the process by contacting a nearby Ostuco sales office, or by writing direct to the Ellyria factory.



Stress Single-Source Service at Ostuco eliminates interplant shipment and return... another reason why your product can be improved when components are made right.



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ENGINEERS...

It can be challenging, but being an engineer that is ready to succeed with McDonnell Douglas is a reward which provides the satisfaction of being part of the profession.

The achievements of the McDonnell engineering team speak for themselves—the Air Force F-15, the Arrow XV-15, the Navy F3H-2 Demon.

MCD is equally interested in developing outstanding engineers as well as superior air weapons. In addition to stimulating and provocative work assignments, advanced in-plane engineering courses are available, as well as supplementary training at two local universities.

Positions of technical leadership exist in virtually all fields of airplane, helicopter and missile engineering.

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Aircraft Corporation

How many riveting and welding operations can you eliminate with

SOLVENT-FREE



Removal of Rivets from Joint (T.M. Goodrich Aircraft Corporation) with solvent-free adhesive.



Wing flap section made from aluminum, bonded with Epox Adhesive VI.



Rivets are honeycomb structure. Epox Adhesive VI bonds aluminum to central aluminum honeycomb.

EPON® ADHESIVES?

New Epox adhesives are being specified to replace expensive riveting and welding in an ever-increasing variety of aircraft applications. Because they contain no solvents, Epox adhesives permit immediate assembly of rivet-to-metal bonded parts. Contact pressure alone is all that is required to form sound bonds. Surface before bonding need not be mechanically treated.

And glue lines need not be uniform. *As-rivet drilling is never needed.*

For your specific needs, three standard formulations are:

- **EPON ADHESIVE VI** General purpose, high strength adhesive. Cures at room temperature to slightly above.
- **EPON ADHESIVE VII** High strength, resistant to water, extremely high surface temperatures. Cures at room temperature.
- **EPON ADHESIVE VIII** A special formula. Cures at room temperature up to 300°F.

Epox adhesives have been used successfully in bonding metal, plastic, rubber and wood for helicopter rotor blades, helicopter wing sections, jet fuel tanks, motor assemblies, structural joints and floor panels. Can Epox adhesives solve an assembly problem for you? Write us about your problem and we'll send full technical information and samples.

(If you desire the specific product name, contact us by Shell Chemical Corporation.)

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The Boeing B-47—in use for engines, each supplying 4,000 pounds thrust, jet it to the 1,600 miles per hour speed class.* Operating range is more than 3,000 miles.

Cold drawn Shelby Seamless Tubes provide *high strength, low weight* outrigger struts for B-47 Stratojet



The landing gear of the 100 ton B-47 Stratojet consists of dual main wheels in tandem with single out-rigger struts attached to the abraded main gear pods. The outer cylinder of each of the outrigger struts is fabricated from cold drawn USSB Shelby Mechanical Tubing.

Shelby Seamless is extremely strong and shock absorber in proportion to its weight. Thus, it is ideal for incorporation into landing gear, engine mounts, fuselage wing spars, fuselage struts, and tail assemblies. Moreover, with Shelby Seamless Tubing, the best shape for ground service parts is already made—and each section of tubing is as sound as the solid steel forging from which it is pressed. Thoroughly uniform and dimensionally accurate, Shelby Seamless Tubing is easy to bend, shape, machine and weld.

Shelby Seamless is graduated to meeting aircraft standards, as a wide range of diameters, wall thicknesses and steel analyses. For further information or for help in applying Shelby Seamless Mechanical Tubing to your design specifications, write to National Tube Division, United States Steel, 565 Wilkins, Penn. Place, Pittsburgh 30, Pennsylvania.

"WALLS WITHOUT WELDS"

As solid as the construction of Shelby Seamless Pipes and Tubes is a complete line of design for drawing in industrial groups. Shown in this advertisement are the brilliant mechanical properties of the most dramatic steel mill operations ever recorded. Write for information.



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SHELBY SEAMLESS MECHANICAL TUBING



UNITED STATES STEEL



Another advancement by

kaupp

New 19 Inch
Hydroform makes...

large prototype and pre-production parts

...now available by
economical Hydroforming

The new 19" Hydroform is an important addition to Kaupp facilities. This new machine makes it possible to produce larger parts than heretofore possible on the 12" Hydroform previously installed. With both machines now in operation, a vast new field is open for design and development engineers who require prototype components. Your inquiries are invited.

HYDROFORMING BY KAUPP SAVES TIME
AND REDUCES TOOL COSTS —

- Fewer drawing operations
- Simple tooling
- Fast set-up
- Improved quality

Specify Hydroforming by Kaupp for accurate forming and drawing of stainless steel, Inconel, aluminum, cold rolled steel, copper, brass and other alloys.



NEW 19 INCH HYDROFORMING—WORK CAPACITY
MAXIMUM FLANK — 19" MAX. THICKNESS — 15,000 P.S.I.
MAX. DRAW DEPTH — 8" MAX. FLANK SIZES — 9" STEEL

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Zenith Wing-tip Pods Protect Electronic Marvels of RB66

Built to perform in the stratosphere or to scrape treetops in low level missions, the new U. S. Air Force RB66, built by Douglas Aircraft Company's Long Beach Division, is one of the most versatile photo reconnaissance airplanes ever designed. The RB66 is designed to fly at 600-700 miles per hour at altitudes up to 45,000 feet. Its range will permit deep penetration into enemy territory for all-weather, around-the-clock photographic and

mapping missions by the most modern equipment yet devised for accurate reports on operations. A vital part of these electronic marvels is protected by and housed in the Zenith-built reinforced plastic wingtip pods—another example of Zenith Aircraft's contribution to our nation's arsenal of defense. For specific facts about Zenith's function in the aerial defenses of the U.S.A., contact Engineering Research Division

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Douglas Bells Del G-133A Transport 26

► USATF cargo aircraft, powered by Pratt & Whitney T34-P-3 turbo-prop with 141 50 jet engines

UK Aircraft Story: Too Little, Too Late 67

► Sir Roy Fedden, three-time president of RAeS, pinpoints weaknesses responsible for Britain's air lag

Atomic Transport 15-20 Years Away 104

► Special report says commercial use will depend on military development, cites high costs, hazards

MIDDLE ENGINEERING TRANSPORT

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TWIN FEATURES FOR THE TWIN-BONANZA are weight saving and rigidity through use of magnesium sheet for the cowlings, cowl and wing.

Private planes, too, made with MAGNESIUM

Vital areas of the new Beechcraft Twin Bonanza are made with magnesium for extra lightness . . . extra rigidity

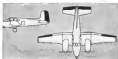
Less weight and greater rigidity. Design simplicity and even refinements. These are benefits of magnesium that Beech Aircraft Corporation has utilized for many years. They build all cabin-crafting product using this lightest of all structural metals. You can do the same thing.

If lighter weight will improve your product, if extra strength will do it, or simplified design and fabrication—then the best choice of metal for you is magnesium.

You'll get prompt attention from your nearest Dow sales office, or THE DOW CHEMICAL COMPANY, Magnesium Sales Dept., MA 5296, Midland, Michigan.



LUXURY TRANSPORTATION for two people is provided in the sleek Twin Bonanza, lightweight magnesium contributes rigidity to a top speed of 214 mph—range of 1300 miles.



PARTS MADE OF MAGNESIUM SHEET are indicated by dark areas in this diagram of the new Beechcraft Twin-Bonanza.

you can depend on **DOW MAGNESIUM**

DOW

EDITORIAL

The Harding Report—A Good Job

President Eisenhower is now looking for a man of sufficient experience and stature to conduct the study of long-range civil aviation needs recommended by Budget Bureau's Aviation Facilities Study Group headed by William Barclay Harding. The President has endorsed the group's recommendation and pledged himself to see that the study is made and a long-range program organized to meet the needs of civil aviation's rapid development.

This decision by President Eisenhower will get virtually unanimous support from both military and civil aviation groups. The only criticism we have heard on the subject is some grumbling that this top-level administration interest in civil aviation is about three years late and perhaps too late to do any real good.

We believe that if properly executed and adequately supported by both the executive and legislative branches of the Government this study and its resultant program can be of great help in solving the already acute problems of civil aviation's growth.

Many Policy Studies

The idea of a national aviation policy study is not new. Since the days of the Monroe Board in the mid-twenties, periodically appointed groups have been surveying the growth problem of both military and civil aviation in an effort to develop a national policy aimed at achieving and maintaining American superiority in the air. Although some of these efforts have resulted in significant Government and to aviation it is evident from the record that present American superiority in the air is primarily the result of the technical skill and management skill of private individuals and organizations rather than of federal government plan.

A good look at the present plight of British military and civil aviation is a good example of how a government makes plans via retail rather than speed aviation development by fostering individual skill, initiative and imagination in a state of bureaucratic red tape.

However, the Harding group has done an excellent job in outlining the principle areas in which the future problems of civil aviation will be found and some of the basic flaws in the present governmental organizations aimed at handling them.

Basic Assumptions

The basic assumptions which the Harding group used as a foundation for their exploration of civil aviation's next 20 years are interesting. They include:

- No global war, continued international tensions and local incidents involving racial conflict.
- The North American continent will be vulnerable to enemy air attack.
- U.S. population will increase to about 210-220 million.
- Gross national product will rise to about \$715,700 billion in terms of 1955 dollars.
- Defense expenditures will be maintained at about the \$30-40 billion level.

Future Factors

The Harding group noted four principle factors that will characterize future civil aircraft design and performance.

1. Commercial aircraft operating speeds will increase from 300 to 1,000 mph, during the next 20 years.
2. Maximum operating altitudes of civil aircraft will rise from about 25,000 ft today to over 40,000 ft, putting jet airplanes into the same stratosphere that is now exclusively the province of military aircraft.
3. Civil aircraft will show greatly increased productivity. New jet transports will have the same annual tonnage-carrying capacity as a large heavy ocean liner.
4. Tended toward lower operating costs will continue with a 50% reduction in passenger seat-mile costs and an 80% reduction in cargo ton-mile costs likely by 1975.

The most important contribution of the Harding group was made in its analysis and recommendations on the post military-civil air traffic control problem. Although the Harding group would see official authority it is so secret in Washington that its work on air traffic control was instrumental in changing both the attitude of the Eisenhower Administration and the leadership of the Civil Aeronautics Administration. The attitude of the President and the Commerce Department in the air traffic control problem can be traced directly to the forthright presentation of the Harding group. The section of its report on air traffic control should be carefully studied by all segments of civil aviation as it is likely to serve as the take-off point for most future discussion of the problem and plans of action aimed at solving it.

Everybody is anxious over the Harding group—Chairman Harding, George F. Baker, Ford M. Glus, N. E. Halaby, Harold R. Hays, Jerome LaBare, T. F. Wallis and J. Gordon Bennett—a vote of thanks for a job well done.

—Robert Hots



This is a cutaway view of Honeywell's HIG-5 hermetic integrating gyro. Compact: six inches high. Accurate: measures the thirteen-millionth part of a circle. Rugged: takes 50 g's and more of shock. The HIG detects and measures any attitude change of aircraft or missiles. Three models of the HIG (HIG-4, HIG-8, HIG-5) are in volume production. They are recommended for radar stabilization, flight control and inertial guidance.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL

Washington Roundup

Profits Investigation

Criticism now in the House Armed Services investigating Subcommittee's public hearings on the charges of profits from an military contracts will open late in month. The delay in the opening has been caused by other legislative business—sessions authorizing the Navy's shipbuilding program, medical care for military personnel, the military construction programs of the three services, and limiting the authority to acquire defense contracts.

In an appearance before the House Rules Committee, Rep. Carl Vinson (D-Ga.), chairman of the committee, stated Rep. Clement Brown (R-Ohio), that the investigation would open soon. Vinson pointed out that the Government has an order over 5000 orders in airplane plants compared with a private involvement of about \$712 million and said that the point of the request was to determine how the "profitability" is working out. The matter is expected to enter the profits of manufacturers to the private companies.

The plan of the subcommittee, headed by Rep. Edward Robert (D-La.), is to notify firms at least a week before their requested appearance date.

Security Troubles

Advertising and public relations representatives must exercise extra caution these days when they submit copy to the Defense Department for approval by the Office of Security Review. It can come back stamped for release without ever having been seen by the service which has responsibility for deciding what is and is not classified. A recent aviation company advertisement was approved with reference to an Air Force project that has just been declassified by the USAF Secretary Donald Quorby. It was withdrawn from publication only when a top USAF general responsible for the project happened to see a proof of the ad. There are other incidents where USAF has not been given an opportunity to exercise its responsibility, including delays given a recent magazine article on guided missiles. Philip K. Allen, Acting Deputy Assistant Secretary for Public Affairs, can be looked at the fundamental conflict between Defense Department and the services over security procedures, but so far has indicated no program to do anything about it.

The office is working on a new advertisement release schedule, designed to show what data can be made public about missiles at each stage as a new weapon's development and operational cycle. Meanwhile, recent Army announcements about its Redstone missile involved in a new order forbidding military men to discuss these projects. It is attributed to the White House. Despite the order, expect more to come out about the missile program under pressure from Congress. Capitol Hill rankings already have brought results in decision to give a special assistant in Defense Department over missile projects.

More Permanent Certificates

A new bill yet under way in Congress aims to direct Civil Aeronautics Board to grant temporary carrier permanent certificates. Legislation will be introduced by Sen. Warren Magnuson (D-Wash.), chairman of the Senate Commerce Committee. His prime interest is in giving permanent status to the Seattle Alaska and other Alaska

operations of Alaska Airlines and Pacific Northern Airlines.

The legislation, though, will open the way for other bids to permanent certificates. They made an unsuccessful bid for this in connection with legislation directing permanent certificates for the local service airlines last year. Both Pan American World Airways and Northwest Airlines are the temporary certificate holders for their Seattle/Portland to Hawaii operations but would like permanent certificates, although both carriers have contended that the route warrants only one carrier. There also may be bids for permanent certificates on international routes.

Carrier vs. Land Bases

House Armed Services Committee vigorously defended the capability of the Navy's carrier fleet in comparison with the Air Force's land-based forces to meet shore attack and counter attack in a report supporting the construction of a sixth Forrestal-class carrier. The next new carrier, according to present plans, will be nuclear-powered.

Pointing out that no surface target, on land or sea, is "invulnerable" to nuclear attack, the House committee declared:

The carrier is, however, capable of sustaining a great deal of damage and remaining afloat and operable.

"The carrier can, by means of speed and freedom of movement, avoid many attacks and minimize the chances of success of all attacks against her. Her maneuverability, speed and underwater protection provided in her design, and the defense capabilities of the ships designed to accompany her, make her a difficult target for destruction by submarine, aircraft, or surface-to-surface missiles, and she is capable of being a carrier force.

"It is an interesting fact that a modern carrier task force is frequently, and in any event can be at any time spread out over an area of 11,000 square miles, which approximately equals the size of the State of South Carolina, a force spread over an area of this size does not present a profitable target to an enemy, regardless of the type of bomb he may be using. This is further emphasized by the fact that the task force is in constant movement, and therefore is almost invulnerable to the effects of thermonuclear weapons. . . ."

Electronics Decree

Some sharp differences already are disturbing signs that important changes will result from the contract device signed by American Telephone and Telegraph Company and International Business Machines Corp. to real Government arm and armor. One report is that the Government is trying to attract wide competition in the electronics industry. Another anticipates formation of a vast new number of transistor manufacturers. However, qualified observers are skeptical, pointing out that with funds of firms already in the transistor business, present production capacity already far exceeds current demand. They declare that any firm that is prepared to invest the \$1 or \$2 million now required to get into transistor production would have trouble at getting up \$25,000 advance funds to obtain a license under the previous arrangement. —Washington staff



Douglas Rolls Out Turboprop C-133A

By Irving Stone

Long Beach.—The largest cargo plane ever to be put into production, the turboprop-powered C-133A, was rolled out by Douglas Aircraft Co. on a cold day last week.

Fast flight tests are scheduled for the end of March.

The plane gives the Air Force a new cargo potential. Compared to its large predecessor, the Douglas C-124 Globemaster, largest transport plane ever in operation, the C-133A has increased capability with respect to payload, speed and range. Over a given distance, such as U. S. to Europe, two of the C-133As are expected to accomplish the same amount of logistic support as five C-124s.

The plane will be able to operate from the same fields that accommodate the C-124.

Tramp Carrying Potential

At present, capacity of C-133s ordered is limited to Military Air Transport Service air freight use, but another potential use soon for the plane is as a carrier for more than 200 troops per flight.

Work on the Long Beach

line for assembly into production starts reaching to the No. 7 aircraft.

Design gross weight of the C-133A is 235,000 lb.—but maximum (gross) gross max push the figure to about 275,000 lb.

Powerplants are four Pratt & Whitney T406-P3 turboprops, each rated at 6,000 hp. at takeoff. Powerplant are Curtiss-Wright Turboprop units, 15 ft. in diameter.

Twenty Jet Engines

Fuselage is 145 ft. 2 in. long and 36 ft. 2 in. in diameter. Main door at the rear of the fuselage drops to form a ramp for dowsing cargo onto the 90 ft. long cargo floor, which is wood and studded with friction strips. Between floor and fuselage, sliding channels are about 15 ft.

Sample loads which can be flown or loaded should by means of the ramp are reported by Douglas to be 10 to 10,000 lb. each, 16 loaded pods 20 jet engines, or various combinations of various heavy ordnance and general cargo.

Forward loading door on port side of fuselage part aft of the cockpit can produce an opening 100 ft. by 10 ft. Cabin is pressurized for high altitude

operation, and heating system has a capacity of about 900,000 BTU.

At about the middle of the cargo area, along the port side are emergency exits for the main electrical load center and electronic gear.

About 11 ft. above the cargo floor along the side of the fuselage is a 1 ft. wide walkway for crew passage within the hold when the plane is loaded.

Lights are strung along the sides along sides at about 6 ft. intervals.

Fuel Capacity

Wing spans a 170 ft. 8 in. The wing houses integral fuel tanks which extend from the tip to the center wing section. Approximately 76,000 gal. of fuel can be accommodated. Fueling can be done from a single point at the base of about 1,200 gpm. Fuel tank booster pumps can be operated without draining the tank. Tank is automatically sealed when pump is activated.

Tapered wing skin is thicker than on the C-124 and stringers have greater depth. Wing section between spars incorporates a piece of skin which is the heaviest (18 ft.) cut used by Douglas. This skin section had to be cooled in order to be heat treated.

Main landing gear struts straight up



FIFTY BOMBS is payload of Douglas C-133, largest cargo plane to be ordered in quantity. Rear (right) and cargo door (above) swings down for loading, showing size and length of inside structure. Cargo (left). Curtiss-Wright pods (above right) show the 6,000-hp of each P&W T40. Thereview shows general layout.

Transport

into barrel pods mounted on outside of fuselage. Each main gear strut carries four wheels and the two and six sets of two wheels can be retracted side, generally so that turn can be changed without picking up the plane.

Rear Wheels

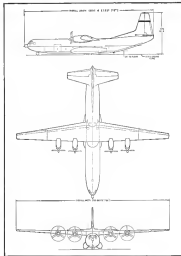
Main gear has dual wheels. Plane is intended to land on fairly flat airfields, heavy soft runways, snow beginning of landing strips, in detail with two small wheels with solid rubber tires which make contact with the ground if plane should land nose high.

Both landing gear pods have a plane pack connection for interconnection between fuselage and main gear.

Air action of port side pod houses two auxiliary gas turbine units for direct, hydraulic and pneumatic use. The auxiliary turbines also supply compressed air to start the main powerplants.

Forward section of reinforced pod carries the structure for single point landing of the integral tanks in the wings.

Plane will be handled by crew of four—pilot, copilot, navigator and systems engineer. There are provisions for housing a relief crew for extended operations.





F101A Voodoo's cockpit is being developed "bring home" seating method is located on fighter's back. Note extreme definition of Voodoo's long chest flap and the rectangular canopies on their upper surfaces. Also note leading edge, suggesting the use of boundary layer control by suction.

Jackson Cites Red Missile Progress

Washington—Sen. Henry Jackson (D-Wash.), chairman of the Military Applications Subcommittee on Armed Forces, predicted that the Soviets would run the race for the intercontinental-range 1,500-mile ballistic missile. He said this development would match the effectiveness of the Strategic Air Command missile with a mid-range B-47 bomber.

He told the Senate: "There is the danger that the Soviets may fire a 1,500-mile ballistic missile before the end of this year—1958."

"Some may minimize the importance of such an achievement. They may say that the Soviets, operating from their present bases, could not reach the American mainland with a 1,500-mile missile. They are mistaken that ballistics missiles will endanger five cities, look when the Kremlin advances a weapon of true intercontinental range."

"This is not the case. The construction of a 1,500-mile Soviet ballistic missile would cancel out our own vital advantage over Russian intercontinental power: an arsenal of oceanic air bases. Virtually all of our overseas SAC bases are within easy striking distance of a 1,500-mile missile. Such a missile could level those bases in a matter of minutes."

"Without these bases, our Strategic Air Force would be a shadow of its former self. Without these bases, the

effectiveness of the B-47 bomber—the prime backbone of our striking force—could be drastically reduced. We could be forced into greater reliance upon the new obsolete B-36 and the long-range jet B-52—both now beginning to break off production lines. A Soviet 1,500-mile missile could turn our strategic thinking upside down. It might well compel us to write off our oceanic bases in virtually useless. A Russian 1,500-mile ballistic missile could force American planes to retreat 5,000 miles from the Soviet Union."

Mach 1.7 Speed Seen For Rocket-Viper MD-550

Paris—The Miraf Viper MD-550 interceptor incorporating a STDPR rocket engine is ready for its next set of tests. The French delta quadplane has been turned back to the company after several months of tests at the French government's flight test center at Bucquoy.

The MD 550, which first flew in May, 1957, is powered with two Viper engines made in France by Dassault under Armstrong-Whitworth license. With the rocket motor, Dassault expects the plane to reach Mach 1.7. The French have previously expressed interest with rocket engines on the

Viper, which has reached speeds of 1,100 mph in level flight with the supersonic rocket engine.

Runaway Regulus "Dumped" in Gorge

Los Angeles—A towing vessel of the surface-to-surface Regulus guided missile spent six days, five near Porterville, Calif., last week.

The missile took off for the training flight from the Navy Corps Auxiliary air station in the Mojave Desert on Jan. 14 for the Navy guided missile and there. The Regulus crashed to the ground, running hoses by only 200 yards, and dug a crater about 12 ft deep.

An official Navy statement said: "Throughout the entire flight the missile was under without control and as far as the missile was at no time a hazard to the general public."

The runaway Regulus got into trouble when it broke into two about 800 ft from the ground and started to climb and penetrate the ground. The control circuit followed the missile to 23,000 ft where there passed atmospheric pressure control. The pilots were able to execute a slow descent through the descent, but because of the missile's low fuel supply at this point, the control pilots were unable to get it back to home base. They were forced to "dump" it to the ground.



Nose Probe of the same McDonnell Voodoo makes contact with finger, pulled from Boeing KC-87 tanker. Voodoo, last USAF production order for McDonnell, is being built also in photo reconnaissance version. Two Voodoos crashed recently, one at Eglin AFB. Photo shows his wingman corresponding to fourth airplane built.

Wilson Creates Missile Aide Post

Washington—Secretary of Defense Charles E. Wilson has established the post of Special Assistant to the Secretary of Defense for Guided Missiles to coordinate the nation's missile program. The new special assistant will have broad authority, acting in Wilson's name, Wilson said last week that the new man must be primarily "a doer" and not an adviser.

Mr. Wilson also said in answer to questions from Sen. Henry Jackson (D-Wash.) (see page 32) that "every thing possible" is being done to push development of intercontinental ballistic missiles and intermediate range missiles.

Wilson's new assistant will act as chairman of the newly-created Ballistic Missile Committee and set up Wilson's aide in contact with the Assistant Secretaries of Defense for Research and Development, Applications Engineering, Communications, Properties and Installation and Supply and Logistics where over these activities affect the missile program.

The new aide also will advise the Armed Forces Policy Council, the Joint Secretaries, the Joint Chiefs of Staff and other Defense Department agencies.

He will make periodic reports to Wilson, prepare any special reports needed, and be charged with preparation of, and presentation of any missile

reports required by the National Security Council and the President.

The new position grew out of efforts started last November to give the missile program "more urgency" and "a good push," Wilson said. The Army and the Navy were brought into missile work more fully and ordered to develop a mid-range missile based on the Army's Redstone. The Air Force, which is working on both mid-range and intercontinental missiles, had its guided mis-

sile program continued at that time. Wilson said he still is looking for a man for the job. "He'll operate at my pace and I'm a little touchy about who does that," the secretary said.

The new aide's job will be similar to that of K. T. Riffin's, who was appointed by the Truman Administration to coordinate the guided missile program before its end as at Defense for several months after Wilson became secretary.

He made some reports to Wilson on missiles and "For been in reasonably close touch with the situation over some time," Wilson said.

Symington Protests Air Cuts

Washington—Sen. Stuart Symington (D-Mo.) charged that the Administration's hopes for a balanced budget for fiscal 1958, which ends June 30, hinge on maintaining the defense program.

"To get this balanced budget this year, expenditures for combat aircraft are being reduced over a billion dollars," Symington said in a Senate speech.

"I've here heard a lot of talk recently about cut authority to compete with the Communists on a quantitative basis, and that, the fact is, we need cut in quality, especially technological quality."

"But in order to achieve this balanced budget in fiscal 1958, expenditures for defense research and development have been cut \$27 million."

Symington, a former Secretary of the

Air Force, also protested that the new power program is being reduced by \$300 million and the Army is being cut an additional \$750 million.

"We have heard a lot of talk and read a lot about being able to cut the Army and Navy and Marines because of the growing importance of air power. Nevertheless, in order to achieve a balanced budget, we are now cutting the expenditures for the Air Force even more than for the Army and Navy."

"All this is even more interesting because of testimony given the Senate in secret session stressing the almost unbelievable buildup in Communist air and sea strength in recent months. Their supremacy on the land has long been known."

Army's Weapon Plan Indicates More Responsibility for Industry

By Claude Witte

Washington—U. S. Army, a increasing emphasis on research and development, embracing better planning and better coordination with questions of requirements, indicates a growing role for industry in providing equipment for the front lines.

This program is not confined to arm and armor and includes a vast field of military hardware indicated as already in the future war. Yet the fact remains that the research and related in defense probably have the most to gain from scientific knowledge of modern Army thinking the kind of hardware that will be needed and the Army's research and development philosophy.

William H. Martin, the Army's civilian Director of Research and Development has been the job for more than a year. Yet he told Americans West, he already is convinced that the most important change in his program is that of present planning. Martin defines that as "the matching of operational needs with technological potential."

This great demand here is striking parallel to what the U. S. Air Force has learned about the challenges before American industry to speed development and shorten the cycle leading to production of weapons.

Concrete Responsibility

What must be provided, Martin says, is "data on which to base sound decisions as to what to develop, produce and test." While the Army's program here the limited early loss Russia to the extent that is quipping USAP is the most, it is clear that American industry is going to learn much more about an ac-

curacy and development problems. Martin recently told the Army Science Advisory Panel at a meeting at Fort Belvoir, W. G.

The design-development phase is one which I feel should be placed largely in industry and that for some complex devices, the design-develop work agency should primarily be the one responsible for the initial production of the new item.

I have this conviction because my experience indicates that it is a responsibility to coordinate responsibility for both design and initial production in one agency. One advantage of this single responsibility (let the responsibility for integration of design and production engineering).

Additionally, we must be data upon the language, skill and experience of industry.

This is particularly important with such new complex devices as guided missiles, automatic antitank and anti-aircraft weapons, where freedom from service friction and ease of maintenance are so desirable.

Powerful Changes

Industry has made wonderful progress in the utilization of such things as automobiles, telephones, radio sets and household appliances. The military, such design for service in which the burden of reliability, maintenance and operating cost have three proper weight along with first cost," he said.

Martin denied his approach is a departure from traditional Army development philosophy. He said that the Army is not alone and which is the most difficult. The difference, he says it, is that a large proportion of the current makes sense have been dependent for the most part on such tools.

This has been required, when in production, to have an irreversible weapon system or suffer the inevitable cost of replacement. There have been times when this worth did not do the job.

The complexity of modern weapon systems the demand for greater accuracy and dependability, have led the Army from 1945 to the present to demand for better industrial performance.

One example of this is the recent move, by the Air Materiel Command to include penalty clauses to be awarded more industry a contractor to meet USAP standards.

Martin emphasizes that his own ideas are not official Army policy. But



William H. Martin has been the Army's Director of Research and Development since last September. Before that he was Deputy Assistant Secretary of Defense for Application Engineering since January 1965. He is a retired superintendent of Bell Telephone Laboratories, a native of Baltimore, Md., and graduate of Johns Hopkins and Johns Hopkins Institute of Technology. He was a professional engineer for his work on military equipment in World War II. He served in the forces of the U. S. Army, reports "that it has not gotten its story across to people outside the Army."

he feels that the best way to achieve these new ideas also means it is to make the initial production responsibility for the initial supply of the special tools, testing equipment and information required for the in factories, testing equipment, operation and maintenance of the new system.

This is a close approach to USAP's weapon system concept, giving entire responsibility to the prime contractor for successful performance of the system in operation.

There are important differences in Army procurement. Most important perhaps is the fact that traditional ground soldier equipment has come from the small part from the Army's own research and contractors who are concerned mainly with consumer products. Tanks are built by factories that make automobiles. The guns come from huge machine tool or automotive plants.

Change in System

Facts of the Army into the field of specialized research and related models in the field of the future. The Transportation Corps still has not solved most of its maintenance problems with local contractors for example, and the Army push is on to speed development of

new types of "small vehicles" better suited in the mission of the ground force. These problems are getting increasing consideration of the Army Science School at Ft. Belvoir, Ariz. (AW Dec 26, p. 15).

It is Martin's belief that industry can and will help in these developments. He told Americans West that the improvement in the Redstone Arsenal, Huntsville, Ala. where the Redstone missile was developed and is now being built. The program was dictated by the fact that the Army needed the skills of about 100 German scientists brought home from Potsdam after World War II.

The same men, still at Redstone, are working now on the new first Army 1,500-mile missile. Again it is a matter of utilizing their knowledge. As in the case of the Redstone, now ready for production at the Chrysler Corp. plant in Detroit, the new missile will be built by private industry.

Emphasis on Planning

Martin, however, appears to recognize the weaknesses of this system. He says that "it is not enough to develop ideas, build models and in preparation for, manufacturing, and particularly in organizing for mass production."

Design development should be closely related to final production engineering, each one entered on the other, in the nature of performance and cost of the product.

Thus, he declares, one "must not consider to the second pattern for the development and production of military equipment. In the areas of weapons, guided missiles and for control systems, industry now is engaged heavily in development and production."

Martin feels that the emphasis on planning in the next program part of his approach to his job. He says he found the Army for a job of where he thought it was in the field of weapons plans. Once there are studies by development agencies, particularly selected and plan in to more on contribution of effort in the field when the program of weapons is highest.

The Army's research and development, or research and development, the Civil Aeronautics Administration, and have had at least 1,200 hours of flight time in pilot within the last eight years of study.

• 700 hours still have been transferred flight time

• 400 hours still have been night flight time

• 180 hours still have been in high altitude flight time

• 100 hours still have been in low altitude flight time

have mentioned a survey of the latest research and development possibilities, we can come up with the idea as to what professionals and drivers are working on in the 1960-1965 period.

With the current and language problems, we are then in a good position to determine what steps we should take in getting from where we are to where we want to be in 1965, and making enough improvements which are not worth the effort and expense.

The Army's Scientific Advisory Panel, based since 1970 by Dr. Joseph R. Kilian Jr., president of Massachusetts Institute of Technology, now has a new chairman. He is Dr. Frederick

L. Blose, president of Texas Instruments.

Martin has suggested that the panel adopt an organization that is divided into two main areas to cover Army interests. They are:

- **Fire power**
- **Mobility on the battlefield and its relation to the combat area**
- **Weapon systems and communication by a mobile and dispersed Army**
- **Logistic support for a mobile and dispersed Army**

"With today's technological potentialities," he says, "we must increasingly select the military equipment rather than try to carry all these that have existed."

CAB Proposes Copter Pilot Rules

Washington—Helicopter certification and operating rules for scheduled air transport are being scheduled for current legislation have been proposed by the Civil Aeronautics Board's Part 46 of the Civil Air Regulations.

The measure of air carrier operating conditions for helicopter operations is currently covered by a special CAB rule, which is not automatic. It depends upon the effectiveness of the Board's new proposal. Since the proposed new rules are being considered for the third time since February 1959 the Board set May 31 for return of industry comment.

At the same time, CAB is proposing an amendment to CAB Part 21 which would establish procedures for the issuance of initial transport pilot licenses for helicopters.

The proposal to add a new section to CAB Part 21 defining the aeronautical requirements for an initial transport pilot license for helicopter. The first such proposal was considered in the early part of 1957 and subsequently was in June 1958.

The revised regulation will require the applicant for an initial transport pilot license to demonstrate a minimum knowledge, experience and skill.

Each applicant will have to hold valid commercial pilot and instrument ratings, or equivalent ratings, for the aircraft to be flown. The Civil Aeronautics Administration, and have had at least 1,200 hours of flight time in pilot within the last eight years of study.

• 700 hours still have been transferred flight time

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• 100 hours still have been in low altitude flight time

• 100 hours still have been in low altitude flight time

be qualified for scheduled instrument flight under the new rules applied to fixed-wing aircraft. Although rules for helicopter flight in night or instrument flight are not specifically prohibited, a helicopter from being instrument flight rules (commercial or military helicopter) has been considered likely to be made.

The IESB, which is now being directed by both the Atlantic and Pacific fleets, is considered by the Navy to be the first helicopter to meet all requirements for instrument flight. Navy operations and the IESB has the ability, flight instruments and communication systems which make the instrument flight in night and dependable as a flight in a single-engine fixed-wing plane fully equipped for instrument flight.

Aircraft stability of the IESB is helped by auto-stabilization equipment, which causes additional stability required for instrument flight under IFR conditions.

As part of the helicopter instrument flight certification project being conducted at the Naval Air Test Center, Patuxent, Md., various qualified pilots have been made IESB instrument ratings.

The first formal pilot to receive such a rating was Lt. Col. William C. Farnett, who recently won flight test at Patuxent.

It is expected that Navy and Marine Corps pilots will, in the future, qualify for helicopter instrument rating in the Sikorsky IESB.

The Navy's helicopter IFR project at Patuxent is part of a long-range program of the military services and is designed to qualify fixed helicopter as transport aircraft. All were aircraft capable of navigation and flying through inclement weather or terrain and under all conditions of flight have been to maintain speed.



Supermarine With Supercirculation

Supercirculation is the main design feature of the Valiant-Supermarine N.113 fighter for the Royal Navy. Developed in prototype form as the V-6 Type 113, the system bleeds air from the engine compressor and blows it over the upper surface of the wing tips during approach and landing. Powerplant of the N.113 is a pair of Rolls-Royce Avons. First phase in the development now was

V-8 Type 526, a straight-wing, two Avon fighter with a baton tail. It was followed by the Type 121, which omitted. Major differences between the N.113 and the 521 include landing-gear extensions to delay tip stall and an all-moving horizontal tail. Other changes have been made in vertical fin layout, canopy, cockpit and nose. A protection collar has been placed for the N.113.

Lockheed Moving Missile Division Into San Francisco Bay Region

Los Angeles—Lockheed Aircraft Corp. will move its Missile Systems Division from Van Nuys to a 275-acre site at Sausalito, in the San Francisco Bay area. Each step in the move will be construction of 94,000 sq ft of main building space at Sausalito.

The company also will construct a number of research laboratories for advanced studies in the fields of missiles and associated electronics on a 12-acre site at Stanford University, Palo Alto, about seven miles from the Sausalito location.

Construction will begin at once on two laboratories, each encompassing 51,000 sq ft.

These new Missile Systems Division facilities are the initial steps in a research and development program on which about \$20 million will be spent in the next three years.

Man Skills Available

Chief of the Sausalito and Palo Alto sites respectively is related to the numerous resources Lockheed has gained in its advancements for engineers and scientists from the San Francisco Bay area. It has enhanced other areas pulled by a rush of new use.

Another factor for looking in the bay area, Gross pointed out, is that it has become "a center of electronic and other research efforts." Lockheed's laboratories at Palo Alto will bring it to a technical center near the area already

traversed by General Electric, Eastman Kodak, and Varian Associates.

Dr. Louis N. Ridenour, research director of the Missile Division, has said that Lockheed plans to develop close association in both education and research with Stanford University. From much of the university and its laboratories, he said, will give Lockheed its members an opportunity for advanced study. Coaching opportunities at the Missile Division will be afforded the Stanford faculty.

Van Nuys Plant

The Missile Systems Division's Van Nuys plant is now engaged in more than a dozen secret projects covering virtually every phase of missile technology, Lockheed reports, and the plant will be fully occupied for a considerable period. When the Missile Systems Division's move to Sausalito is completed, other Lockheed activities will move over the Van Nuys plant, since Lockheed is planning an expansion of research and development and production facilities in Southern California.

Missile Division personnel are scheduled to be at work at the Stanford site this fall, and at Sausalito by the end of the year with 500 employees expected to be at both sites at that time. The division now employs about 1,000.

The Missile Systems Division has had a troubled past. Organized late in 1951, it moved into the Van Nuys plant in

1954. The following year building plans for Van Nuys were cancelled, partially due to the plant dispersal policy laid down by the Department of Defense.

Late in 1955 there were a number of resignations among top-level personnel (AW Dec. 19 p. 16). Edward R. Ormside, Lockheed vice president and general manager of the Division, resigned in November. The following month, about 20 more Missile Division scientists resigned, including the head of the research laboratories branch, director of the company and country laboratories, chief of the systems laboratory, and assistant head of the nuclear section. The resignations reportedly followed a decision by Lockheed management that the Missile Division's research laboratories would not have a controlling influence in projects of a research nature.

Short Reserve Enlistments Are Closed to Technicians

Because aircraft and engine mechanics, electronics technicians, instrument repairmen and technicians are "highly needed" in the armed forces, they no longer are eligible to enlist in the three-to-six month enlistment reserve program.

Office of Defense Mobilization declared the loss of skills from the short enlistment list after conferring with the Secretary of Defense and the Interdepartmental Manpower Policy Committee. GDM pointed out, however, that journeymen and apprentices in these occupations still are eligible for occupational deferment.



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Bill Tightening Contract Policies Probably Won't Affect USAF, Navy

Washington—Legislation tightening the authority to negotiate defense contracts—which some expect to be enacted—will not appear to have much effect on the contract policies of the Air Force and Navy's Bureau of Aeronautics.

The Assistant Secretary of USAF for Materiel, Dudley Sharp, explained to House Armed Services Committee why the bulk of military service contracts will not be negotiated, despite the policy of the 1947 Armed Services Procurement Act declaring competitive bid contracting the rule and making negotiable contracts the exception.

During Fiscal 1955, approximately 95% of the dollar amount of all of our procurement contracts reflect the procurement of supplies, engines, complex electronic equipment, the aircraft and weapons, weapons, guided missiles, and research and development work. The reason for the very high percentage of dollars which we place in acquisition that becomes readily apparent. Further, we must frankly admit that we know of no way that these major items can be procured by formal advertising.

Legislation proposed by the House Committee would strike out the authority to negotiate contracts because of a President's declared "emergency." For the past few years, all negotiated contracts have been notified by the emergency declared by former President Truman in December, 1950. This action, sponsored by Rep. Carl Albert (D-Cal.), chairman of the committee, would require that as "emergency" be declared by the Congress before it could be used in justification.

The committee would grant that negotiation must be prohibited under one of 17 permanent exceptions to competitive bid contracting in the 1947 act. President's emergency was simply that it was "closed" because it involved this reporting requirement. They insisted that all contracts negotiated under 1950, however, could be justified under one of the 17 exceptions.

Among these exceptions under which the services are permitted to negotiate contracts, are:

- If "the public interest will not be served by the delay incident to advertising"
- For supplies or services for which it is impracticable to secure competition
- Contracts for experimental, develop-

mental or research work, or for the manufacture or forwarding of supplies for experimental, development, research, or test

- For classified projects
- For technical equipment when standardization is necessary in the public interest

• For specialized supplies requiring a substantial initial investment or an extended period of preparation, for acquisition when it is determined that consecutive bidding "our acquire duplicate of contract in preparation already made, or will satisfy dual procurement."

• Where it is determined "that it is in the interest of the national defense that any plant, arm, or facility or any product, installation, or service be made or kept available for furnishing supplies or services in the event of a national emergency."

Kits Will Reduce AMC Overhaul Costs

Trainer AFB, Okla.—Purchase of overhaul kits instead of individual parts will be started soon as part of the Air Materiel Command's continuing drive to cut costs. These overhauls refer to U. S. Air Force equipment.

Okla. City Air Materiel AFB, one of the world's largest jet engine overhaul facilities, will launch the program on a small scale here with the overhaul of pumps, valves and transfer engine accessories. Later, it is anticipated that the program will expand to include aircraft, engines, electronic components, and all other moving equipment purchased by the Air Force.

Twenty-five members of the Aircraft Industries Assn. are attending a two-day meeting at this headquarters to study the new program and lay plans for its application to other commodities.

Figures provided by the Oklahoma City AFB show that under the Air Materiel, USAF actually will spend more money for replacement parts, but savings effected in these purchases have offset and distribution will bring substantial overall economies. In the case of overhaul kit use, the item, cited as an example, there will be direct savings of \$5,252—most of it in paper work and storage expenses.

The new overhaul kits will include only the most critical repairs required for field maintenance or overhaul, as well as those for which there is a high replacement factor. This will eliminate the

need for provisioning procedures for stock items, and will help other small items needed by the field aircraft.

It is estimated, for example, that the Oklahoma City AFB is the prime source for 500 and items and that it handles with about 11,000 separate spare parts in order to service them. Under the new program there will be only 1,500 kits to do the job, divided into 950 maintenance kits and 550 overhaul kits.

In addition to the cost savings expected from the kit program, AFB sees other advantages:

- Stock kits will be shared of thousands of units
- Future depots and overhaul bases will share the majority of spare parts needed

• Complete repairs will be possible at more bases

• Follow-up and expediting orders will be reduced

• A check in repackaging and transporting costs

Items which cost less than \$1 will be automatically replaced under the new system. This will eliminate clearing and processing expense which usually runs to more than the part's original value.

The kit program that will process the service test of the new program are: Add Precision Products Corp., Air Research Division, Garrett Corp., Union Electric, Bendix Aviation, Power Products Division, Borg-Warner Corp., Thompson Division, Inc., and Victor Inc., Division of Sperry Rand Corp.



Army to Test New Air Scout Vehicle

Numerous improvements to increase performance will be featured on the AT-16 Lockheed Hercules that will be used to conduct Army ground tests this summer. Compared to prototype pointed nose, new version will have larger wheel fairing blades, mechanical transmission replacing left drive shaft will be 50 ft. lighter. Army will evaluate the new test version vehicles for three months, paying about \$21,000 for each machine for this period. Interest in the Lockheed Hercules is part of an Army contract program to increase battlefield mobility by ground units under adverse test conditions.

It takes little experience to fly the Aero-cycle-the address-experts show being the most skilled after only 10 min. of ground instruction.

Presented in a 10 ft. Kiehlert-Mercer overhaul engine, complete fuel tank, wing, and a 10 ft. section of oil, provide range of about 150 mi.



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Aeropot Gets Contract for Liquid Rocket Facilities

Air Force has awarded Aeropot-Gelco Corp. a \$9,000,000 contract to build facilities for the pilot production and production string of liquid rocket engines.

Under recent Air Force contract, General Dynamics Corp., 22115 100th St., Littleton, Colo., is to build a \$10,000,000 facility for the production of 10,000 engines for the Air Force. The facility will be located at the Air Force Plant No. 1, Littleton, Colo. The facility will be used for the production of 10,000 engines for the Air Force.

Marine Air Freight, Jacksonville, Fla., 40 ft. trailer.
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Marine Trucking Center, Great Lakes, Ill., 40 ft. trailer.

Bell Seeks Death Penalty For Aircraft Saboteurs

Legislation authorizing the death penalty for any sabotage of aircraft which results in death was introduced by Sen. Warren Magnuson (D-Wash.), chairman of the Senate Commerce Committee. It has Administration support. The measure sets a penalty of \$10,000 or 20 years imprisonment, or both, for aircraft sabotage which does not cause death.

Nationwide search bells have been sounded since the opening of Congress as a result of the explosion of a United Air Lines plane near Denver last fall, in which 44 died. It was caused by a bomb placed in a passenger's baggage.

Army Sending 63 Cargo Helicopters to Germany

FRANKFURT, Oct. 15—U. S. Army is preparing to ship 63 Sikorski H-34 light cargo helicopters to Germany. The first unit, the 95th Cargo Helicopter Company, will leave next week for Stuttgart where it will be attached to the U. S. 7th Army.

First shipment of 21 H-34s will be taken to Europe aboard a Navy cargo ship from Norfolk, Va. Three more units are scheduled to go aboard before June 1.

Air Cargo Group Names Johnson as President

Emory F. Johnson, 45, has been elected president of Air Cargo Inc., by the board of directors meeting in Washington. Johnson first joined ACI, the scheduled airline's aircraft pickup

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Type 10026, for temperatures to 315° F.

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Tapped holes in soft metals have long presented problems to aircraft manufacturers. Threads wear rapidly, are easily damaged and are susceptible to stripping. Fasteners made of harder alloys are a partial answer. Such inserts, however, have a tendency to plastic flow under vibration, or to back out when the bolt is removed. The only alternative is to position them with a secondary fastening device such as a key or a "Dutchman" pin which then presents a difficult and costly service problem. In cooperation with aircraft and aircraft engine builders, ESNA has developed a new lockfast design which eliminates these problems. Type 2424 lockfasts are self-locking externally and internally. They provide a one-piece, vibration-proof steel fastener (insert) that develops 45,000 lb. tensile loads, is dependably self-removing, yet can be readily removed with simple tools.

Early accepted in an NGC-2 tapped hole, using simple tools, the type 2424 lockfast can be locked in place by the nine-revolution action of the patented Lath. Thread system, which removes the lockfast thread to the equivalent of a perfect selective fit.

The internally-threaded sections use one of two thoroughly-proven ESNA self-locking devices. For temperatures up to 250° F., the new fastener is available with the internal and external locking collar. For service between 250° and 325° F., it comes equipped with the all metal Lath locking device that has been tested on many types of ESNA high temperature lockfasts. Both lockfasts are available in sizes 8-16 threads, 1/8" and the locking device permits performance and assembly per Space Station AN-N-5b and AN-N-10s.



Lock fast—internal fastener design used for holes of various sizes. The fastener is self-locking and can be removed by the use of simple tools. The fastener is self-locking and can be removed by the use of simple tools.

Type 2424 lockfasts can be installed in any material where hardness is less than 25 Rockwell C, including aluminum, magnesium, plastic and mild steel castings. Non-plated metalization and lock maintenance lockfasts are available. And because Lath Thread method of external locking creates less heat stress at the base of the casting, ring distance or base size is reduced 1-2 mils depending weight settings.

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and delivery architect, in 1947 as
inspector and level agent. He was
elected vice president/general manager
in 1956. A 25-year veteran of the air-
line industry, Johnson has worked for
Trans World Airlines, United Air Lines
and the Air Transport Assn.
The ACB board action also included

the election of two new directors and a
general counsel. New directors are
Stuart G. Tipton, ATA president, and
Alexander G. Haskin, senior vice president
of National Airlines. Russell S.
Bernhard was named general counsel
succeeding Stuart Tipton who resigned.
All other officers were re-elected.



Inside New Grumman TF-1 Utility Transport

Striped of its exterior fuselage filler equipment and scenery, the two-engine Grumman
TF-1 business, the new 17-1 passenger-cargo transport capable of carrying nine passengers
in normal facing seats (shown) or in a considerable freight load in special "cage" (below).
The well-packed high strength seats have built-in head rests and are equipped with
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The cage seats consist of two parallel sets of variable vertical ballast rods installed between
hinged metal rails. Vertical rods can be rotated on wheels along the cage depending on the
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as shown in the rear of the engine nacelles, seating, windows kept close to the SIF.
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Machinists Drop Drive For Joint Negotiations

Washington—The International Association of Machinists has decided to drop its drive for joint union contract negotiations, but it will continue to push for industry-wide uniformity when possible.

The decision to abandon several years of effort to establish joint and verify to individual negotiations came out of a meeting of representatives of IAM airline groups last October, where considerable dissatisfaction with past bargaining was expressed.

In December, the IAM executive council met and decided to go back to individual negotiations between the airlines and the local labor units. IAM President Al Myers explained that the change was made because of the feeling in Machinist groups that their members were missing something they felt might have been won in last year's negotiations.

The negotiations that ended the long-term "meat" Machinist contract was between the IAM and an airline in 1954 and 1955. Then began in May, 1956 when contracts were signed between the union and the airlines—United Air Lines, Trans World Airlines, Northwest Airlines, Eastern Air Lines, Capital Airlines and National Airlines.

For these negotiations, the IAM gathered about 100 local units of the local Machinist unions involved and drew up a set of joint proposals. Five of the airlines agreed to bargain jointly, but Eastern Air Lines finally decided to go its own way and bargain separately with IAM.

After a strike rate was taken and prolonged negotiations between the parties and with the National Mediation Board failed to make any progress, President Eisenhower stepped in and set up an emergency board to stop a strike in November, 1954.

After lengthy hearings and further negotiations, contracts were signed in March, 1955, with the five airlines contracting terms of the common principles favored by the IAM. Eastern signed a contract in April.

Although the Machinists deal with 16 airlines contracts, efforts to establish joint negotiations were concentrated on the six trunk airlines because their representatives about two-thirds of the IAM's 10,000 airline members and are pattern setters for other contracts.

When the contracts between the trunk lines and the IAM expire in October, the union will go back to the old pattern of individual bargaining. But efforts to establish industry-wide uniformity in wages, job classification and other factors will continue actively.



How Navy Planners View Tomorrow

The Navy's 1957 construction plans include proposals for three new types missile launching ships. Top drawing shows the proposed paper-disc guided missile ship with ten aircraft and early warning capabilities. The center drawing shows an anti-aircraft integration of a multi-purpose carrier of the future equipped with multiple missile launchers. Author's conception below is of a proposed anti-aircraft, anti-submarine ship.



AVIATION WEEK, February 6, 1956

ADVANCED

The design of modern communications equipment involves much more than electronic circuit techniques. Keyboards and coders are often required to translate the intelligence to be transmitted into "machine language." Recording and reproducing devices store intelligence until the equipment is ready to transmit it, or hold received intelligence until it can be translated back into human language by a printer or other output display device.

The combination of such mechanical and electro-mechanical techniques with the better known but still developing techniques of electronic circuit design makes of modern communications a much broader field than is commonly recognized. When such technical tools are used to provide engineers trained to our rapidly improving understanding of propagation phenomena and information theory, the resulting practical improvements in communication are sometimes little short of spectacular.

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New York University (George M. Kohn, principal, 212-850-1800), Poughkeepsie, N. Y., is a N. Y. driving classroom around components for automation to high-temperature systems like fluids. Within 10-150 ft. (10-40-150 ft.) 212-850

Shimizu and Kawai (1990) found that the
market stock, capital structure, and the
industry effect are not significant.

Authorities: *See* *Abstracts*; *Index*; *Key*
 Number 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833,

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EFFICIENCY OF THE J44-1, large version of the Fairchild J44, reflects its ductlike origin. The engine is confident that response and low cost, coupled with each delivery, will more than offset its engine's low compressive performance. The small model and this compressor is a departure from the original ductlike function and will not be used in future Fairchild designs.

Fairchild J44 Designed to Replace Rato

By Robert H. Cadman

The Fairchild Engine Division hopes to place its small J44 turbojet engine in the market by late spring with the Fairchild, despite its replacing Rato in civil and military transport and cargo operations. The engine, only U.S. designed small turbojet as anything more than taken production, already has completed 95% of the 150 hr. of

limited aircraft qualification run required in military specifications. A large cargo jet set in the Fairchild for the 1,000-hr. three-year test is to simulate aircraft designers who considering small turbojet around which this can plan any type aircraft that will take advantage of the small engine's ductlike features—particularly 400 lbs. thrust to weight ratio combined with small frontal area.

The J44 also may help pace the way for a new crop of small turbojets expected out of present development programs in Fairchild and its competitors, including General Electric's research-backed Small Gas Turbine Division

(which has a joint study contract with Fairchild on a new 2,000 lb. subject), Westinghouse, which became of its agreement with Bell Helicopter, and Pratt & Whitney. General Electric's J44 is also undergoing a 150-hr. qualification test, according to Curtis-Wright's recently acquired Turbofan Division, and possibly Boeing.

J44 Features

Although late engines may come along, Fairchild feels that it will be some time before these engines can be released from their initial obligations and that the interim will provide the J44 a reasonably long and profitable sales life. During this life further improvements should bring the price down from the present \$17,500 to \$10,000 to below the \$10,000 level, possibly as low as \$7,000.

Over the same period, A. T. Cullen, chief engineer of the Engine Division, says the thrust can be brought up to 1,250 lb. and the specific fuel consumption down to 1.5 from the present

1.55 lb. of fuel per pound of thrust per hour. These performance improvements will come through increasing the compressor tip diameter and by increasing the gap to approximately 75°. This will raise the compression ratio from the present 2.5 to 3.5.

The small J44's history has been the most opposite of that of the expendable and large 4,500 lb. thrust Allison J17. The J44 was conceived eight years ago as the cheapest sort of expendable, turbojet powerplant for a subsonic aircraft. It was designed to be a subsonic engine, equipped in a sense of usage. It was designed as engine with simplified, reproducible applications to nondeductible and then to subsonic experimental. Now, it is on the head of bolt acceptance for use in subsonic aircraft. The Allison engine, on the other hand, started out as a pilot plant powerplant and in the J17A-17 version was re-engineered into an expendable thrust source for the Martin and Republic missiles (ENR, Sept. 27, 1954, p. 58).

Since the J44 and the J17A-17 have

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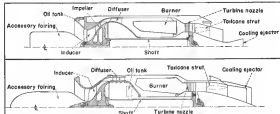
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LONGITUDINAL HALF-SECTIONS of J44-R-6 and J44-R-20 illustrate the major changes in engine proposed from one-shot category to convertible design. The R-20 closely resembles, in appearance, the R-33 installed model (p. 34).

headed opposite paths, it is not too surprising that the losses Fairchild incurred in the process appear to not reflect Allison's.

Fairchild found that too readily "cheap" an engine is a real concept (one goes out to be more expensive in production than a more conventional engine).

Allison, testing in the opposite direction, found that some of the trucks learned in developing an expensive engine could then be fed back to improve the expensive version.

In such a comparison, fundamental differences must be recognized. The J44 is much less complex than the J33, even when comparing the exhibited version of the J44 against the expendable version of the J33 and so far has not achieved similar production volume. To date, the largest (never) J44 output has been only 246 engines. And production volume, in Fairchild's A. L. Brown point out, "can mean more to the cost of an engine, expendable or not, than other design features."

Fairchild, therefore, decided to seek responses from its own engineers the J44 so that it could stand up to the J33 for qualification test. Later, a sales campaign was organized to exploit the idea of small jets in both the military and civilian markets.

Reduce Powerplant

The J44 received its first boost in the present upgrading when the original proposal for the first fighter drove the Frederick Heide 151, failed to meet the delivery schedule because of troubles in its engine single stage expansion compressor. Although the Continental J58 also has been installed in the design, the J44 has presented the main portion of the J44 flight testing and other programs which have culminated in successful altitude flights up to 45,000 ft at speeds in excess of the J58 high speed needs.

To Fairchild's way of thinking, however, the demand for conversion of less than 600 engines to dual has not been big to top the small engine's potential.

Two factors had a major share in reinforcing Fairchild's decision to upgrade the engine.

• **Long life potential.** Manufacturing engineers only a 1954 Navy contract to study potential and select engines but indicated that the engine had long life potential.

• **The J44 had little competition** on the side of the ocean. At that time most of the new U.S. designs were headed two sides larger and larger thrust. Two foreign requests, however, were considered in opposition: the Rolls Royce Scorpion and the Continental J59 development of the French Turbomeca M5000 II.

The Scorp., in spite of its advanced thrust-to-weight ratio of better than double the J44's 5.0, would not last but would a few hours and the J59, although a bit better fuel consumption, was more complex.

Fairchild, therefore, decided to seek responses from its own engineers the J44 so that it could stand up to the J33 for qualification test. Later, a sales campaign was organized to exploit the idea of small jets in both the military and civilian markets.

The first use of the J44 as an industrial "military prototype" was Bell's small jet VTOL. The 2,200 lb thrust (above the design stage) of two vertically positioned J44s lifted the 2,600 lb test craft off the ground in November 1954 (AVF, Feb. 7, 1955, p. 16). Subsequently, in fact, no other use of the J44 was concerned, this use little more than an isolated demonstration test with GPE engines.

First positive step, after some evaluation had been made, was making use of the J44's jet engine (one of the production model could pass the 90 hr. written specification for preliminary flight testing).

This early in 1955, Fairchild staged a color demonstration tour of service men demonstrating what two wing-mounted J44s would mean to a C-119 in added performance and land use.

But some of the most basic changes in Fairchild's thinking on the J44 occurred even before the engine was installed in the original Navy's rocket jet test evaluation in 1949. A. T. Conner explained, "Since the engine would only last for a few minutes in the missile application we thought it could be welded together as a reusable, race and for all run a couple of hours for a quick check and dropped it. Then if someone did want to open it for any reason, this could be fixed to use a new engine. But by the time the first engine was built and running we had developed considerable faith in the engine and can ignore concept."

Later in the Fairchild program, when the dual's parachute recovery system was proving more effective than air-to-ground, even wanted to test the engine down for a while (about 1000). The design for reusability took the J44 one step more away from the "throw-away" or "one-off" concept.

Lower Cost

Not only did Fairchild change its philosophy on how to go about assembling the components but the manner in which these components were manufactured. It had been thought that the engine needed modest production (150), the engine was first built was detailed in AVF, Nov. 10, 1953, p. 30.

Two important points, the diffuser and the turbine nozzle, have now been up with control. It had been thought that were the vendors got these baked up, it would be just a matter of moving the single piece jobs into the plant and

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then assembling them into the engine,
according to G. A. Fajana, of Fairchild
Production Engineering.

Production Problems

On testing the engine as they came
out of manufacturing, it was found that
apparently minor differences in the air
pumpage from casting to casting made
component matching, a labor-intensive
operation. At one time, spray valve
as high as 50%.

Sometimes the faulty part was de-
fected before it was placed into the en-
gine, but at other times, especially at
first, it was not found out until the
completed engine had reached the test
cell and then only after time-consuming
back-chasing. When Fairchild is
world in hand or working, it was found
that the individual workman's taste
showed up in certain performance so
sensitive was the engine in this respect
that the way in which a particular part
was filed a grade made its looking differ-
entiable in the higher velocity diffuser,
reflected itself in acceptance-test re-
sults.

But when fabricated steel metal
assemblies with die and tooling
users were substituted on both these
parts, Fairchild found the flow passage
tolerances could be held and produc-
tion met. It was easier to
design engineering requirements into the
production line, and the cost went
down, too. (This agrees with
General Engineers Ltd.'s [Cinelec] ex-
perience on their production, where it
was found that going to a fabricated
metal assembly after using a steel casting
not only lowered the weight but the
per-unit cost, from \$3,800 to \$1,600.)

Streamlining the component-casting
geometry of the diffuser casting, flow
paths to suit the angle-cast-in, laminar
flow of sheet metal forming did not
improve efficiency. Because at the
same time these rounded stages of
close-tolerance direct vane were
worked into the design, the overall
compressor efficiency actually went up.

The original production plan called
for a stainless steel duct tube to be
used as the turbine shaft. Cutting up
consequently available tubing, shaft
clarity seemed to be an intelligent ap-
proach to a short life product. But here,
too, minute variations caused trouble
that cost because they made balanc-
ing the rotating component difficult
without a much longer wear
member rejection. After taking this
method along for three years, Fairchild
reverted to a more conventional ma-
chined shaft and shaft, and the cost
was reduced by one half.

Altitude, Performance Gains

The original Navy missile specifica-
tion in 1947 called for a maximum alti-
tude of only 35,000 ft., as did all 65

and a weight of 300 lbs. Since one of
the missile's three missions was to
smash high altitude bombers, more
lighter, lower the 144 had to be
imposed. As in the case of most en-
gines, which enjoy some sort of
production life experience and further
development intended to work in which
the basic design could grow in efficiency
but at the small cost of weight. The
original weight was 276 lbs. That has
grown now to 375 lbs. for the pilotless
version, 378 lbs. for the piloted.

Modifications

The specific modifications which
made the J44 a better engine during
its three developmental stage were:

- Inlet duct changes which added to the
diffuser efficiency increased the com-
pressor ratio from the original 2.5 to
2.7 which in turn lowered the static to
1.75. Most noticeable change to the
diffuser is in shape of the leading edge
to reduce the surface.

- Enlarging the combustion burner
holder and changing its inlet pattern to
suit its operating altitude.

- Streamlining the turbine shaft
and increasing the turbine diameter
so three lbs. more could not reflect
back on the turbine blades. The flow
characteristics also changes resulting from
three alterations described the exhaust
nozzle efficiency. Instead of building
up the compressor of the static flow
to a divergence behind the shaft, the
flow now becomes more continuous,
concentric.

- Lubrication system alteration. While
and of the new system or waste type
it was changed from the "line out" to
the true "mist" system.

- Fuel pump was changed from a special
centrifugal unit to the more com-
mercial type to improve opera-
tional at altitude. The centrifugal
pump not only needed a gear pump
boost for its inlet but was costly main-
tenance in open changes. Pump creation
it actually improved this.

The payoff from these changes was
a successful test of 650 mph at a sea-level
30,000 ft. in the Philadelphia
Naval test facility. After report
out during the test, the J44
proved that it could be thought
back to less than the operational
system of 1947 without flame out in the
re-designed burner.

Rodexign For Inhibited Use

During February 1955, management
told the J44 project to go ahead and
make the changes which would suit
the J44 through the fall 1956 when the
secret qualification test. By October,
the J44-3 group had their new model
ready to start.

The changes made during these eight
months were:

- Revised jet sections, changed out-



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through two windows of a three-phase motor up to 1 hp, and is also used in other types of motor winding open turn — ElectroShop South & Mass Inc., Chicago 25, Ill.

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Convair personnel are pretty proud of this achievement in developing the new jet, two-place interceptor which handles just like Convair's top performer F-105A. They appreciate the confidence placed in them by the General Dynamics Air Defense Command for which they are producing these aircraft. Likewise, Cherry Rivets personnel

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Britain's Aircraft Production:

Too Little, Too Late Plagues Industry

By Sir Roy Todden*

What are the nation's needs in aircraft? I presume we should all fully agree that they are plentiful, to have an adequate Air Force to defend ourselves against an aggressor and then, in the very pressing and ever-increasing air transport field, to have a sufficient range of competitive types to meet our own needs, as well as to keep a reasonable share of the valuable world market for the next 10 years ahead, so as to occupy the hard core of our now important aircraft industry, which employs about 250,000 people.

There can, I venture to say, be no doubt at all of the vital need for these requirements. In spite of all the "soothing syrup" of the Summit talks (jet Geneva) was held in the summer, followed by the Geneva fiasco, let there be no doubt whatsoever there has been no change in the Kremlin's tactics or ultimate aims. Recent articles in the press have, I hope, at least brought home the true facts to the non-on-the-spot.

The Times reported fully on a NATO conference held on October 18 last, at which General Sir John Whittington, Commander of the Permanent Chiefs of Staff and that Russia retains the same number of active divisions, but they are greatly improved in quality and equipment, and the new results apply to her Air Force. The Soviet Bloc, therefore, retains the initiative, and, as Sir John's view, the threat is now greater than ever.

At the same conference Admiral Wright, U. S. N., Commanding-Chief Atlantic, stated that the Russians pose the largest submarine threat the world has ever known, exceeding that of all other nations put together. During 1955, the press has been full of statements and reported speeches, alluding to the expansion and competition on men's line world air transport. The taken are indeed high, and are stated to be of the order of 2,190,000 aircraft, making the colossal figure of 56.5 billion quads over the next 10 years.

At the same time, according to that of all other nations put together. During 1955, the press has been full of statements and reported speeches, alluding to the expansion and competition on men's line world air transport. The taken are indeed high, and are stated to be of the order of 2,190,000 aircraft, making the colossal figure of 56.5 billion quads over the next 10 years.

Expert Market

These figures take no account of the smaller fleet and personal types of aircraft. These requirements being lower, how important it is for the culture of our civil air lines to be capable of retaining a first share of this important world export market.

The next question before us is "In the nation's aircraft needs of the right type to meet these widely differing needs?" The answer is definitely "no."

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In some 2,600 modern supersonic fighters and 300 strategic bombers, but actually, we need more in service. I imagine under 600 of these fighters and less than 50 "V" bombers.

So far, but though it is America's interest, therefore, look to it for the next few years to make a serious contribution to the air in the event of an emergency. In fact, our position in this respect is not far removed from what Poland was at the beginning of the last war.

Civil Air Needs

As regards civil aviation, we have advanced manufacturing systems in one new world market. The new 12 aircraft is a transatlantic flying time for few other new types which are just coming along and have still to be "won their spurs." To hold what we have already gained in the world of transport markets and consolidate the field on the other new types coming forward, is a difficult question raised as a result of the following:

A new line could air transport is a

highly specialized form of airplane and its design features and construction parts are all vital to the end result. The engines, systems and structural design are relatively put in proportion to the structure at the manufacturing. Such a complex piece of engineering cannot be undertaken except in a large firm with considerable financial resources, equipment and with adequate highly skilled design, development and production staff. When I say "large," I mean large, and in the past we have made the regrettable mistake of believing that a comparatively few capable, hardworking people can attain the desired results in this type of airplane.

Development Cost

Of course, given time, anyone can design, make and develop a successful prototype, but long before it was finished it would only be fit for the scrap heap, as it would be outside out of date. I can not emphasize that more than at the time of the design and development of the right number and type in an absolute accuracy to go quickly enough, and in this respect up to the present, we have sadly failed to appreciate the position.

None of us who had the privilege of attending the Anglo-American Air Conference last summer shared one line that aircraft in only over the next few years for a new transatlantic air liner will be \$36 million, an engineering alone (i.e. design and development) and this sum will be expended up to the time of the construction stage. This figure is a very large sum, and in labor costs is the maintenance of the prototypes or tooling for production. I am not suggesting that it will be necessary to spend the same amount of money in this country, but nevertheless, I want to emphasize that it is a very big and serious undertaking.

Successful Airlines

A successful airline is one in which the objectives have been properly understood by the designers, not exactly dictated to them by the customer or the government. Only by unclouded design investigations at the outset can the framework of design be safely laid down and a basis provided upon which successful development and efficient operation can be possible.

This demands superb leadership from the chief design engineer, who is accepting an immense calling for a lifetime test of human judgment and control of a considerable engineering

First of a Series

Sir Roy Todden, first time president of the Royal Aeronautical Society, delivered perhaps the most famous and vital of Britain's post-war aviation lectures yet to be made at the recent fourth Conference on Problems of Aircraft Production. Because of its importance and brevity, Aviation Week has decided to publish the entire address. It will appear in four parts, the first of which begins on this page.

staff. The most time-consuming knowledge to do this, he recognizes, as well as knowing his own mind. To be successful, he will require an exceptionally well-balanced judgment to guide his decisions in making the right decisions. All this may slow the pace.

Loss of Experience

One of the big problems confronting new engineers is lack of experience in designing for safety questions. In other words, the design groups have not well-trained men who have been through the hard school of experience in the complex business. No technical background does not mean that new engineers, although to appreciate, and submit the present status of the land will go some considerable way in helping this condition.

Because of this lack of experience, few British design teams on civil work projects are adequate replacements, engineering design group.

There is also a serious dearth of good mechanical engineers, and it has been common in the past to use aircraft engineers trained by civil control engineers. Often it will be seen that these classes of important engineers are not regarded by professional organizations, and it is not unusual to find structural and mechanical departments in the whole team. Such a short-sighted policy, if

perceived, invariably ends in serious trouble.

Lack of engineering manpower on British and aircraft projects is a broad-based difficulty. Certain past war projects, which were not only because of their technical nature, but also in their own right as projects of equipment.

This has occurred because of inadequate training and too much a number of British engineers, not only to design the aircraft itself but to cope expertly with the whole gamut of other equipment systems, from the different elements and other related control systems, which together add up to a formidable undertaking. Because of this lack of personnel for too many reasons, new teams have to be taken, and there is no shortage of suitable documentation to assist in such a task which will not fill the bill, because of the time factor. Some of these last teams are selected from the military side where such competence has to be accepted fairly often.

Too Late, Too Little

Consequently, in the final months, the work day steps is rushed too late, and often the workday is merely a monkey, representing what is already inadequate.

The representative of the airline dealing with the manufacturer is usually

a sophisticated person, who is not going to be taken in with rough performance comparisons, especially when millions of pounds are at stake. He expects a complete description of the aircraft which is offered for sale, including detailed performance information, presented in such a form that a proper operational evaluation of the machine can be made.

Borrow U.S. Sales Book

Unfortunately, some British firms do not yet seem to appreciate the need for presenting their technical sales data in an internationally acceptable form, which, owing to their American order experience, is not too far from being a common sense. It is common to find that the British firm is not yet in the position to accept anything American, but rather than give it a try, they have had to alter their sales policies and data logic to cause other countries when they have entered new markets should be equipped by U. S. A., so that it would seem strange that we should build, over this one.

Another point where no right reply seems to be a fact of the U. S. A. is sales book, in to include thorough guidelines regarding to act as guidelines, who can discuss performance and other technical features of their firm's products in full detail. This

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by



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men should take much of the load off the design office and the inevitable waste of time for these hand-picked people working from going round round-ups and discussing various questions with the designers of prospective containers and vessels.

A brief rehearsal should be made to electrical solutions and properties. In the construction of the latest aircraft, numerous substituted groups in weight and different better results can be obtained, all of which is fully appreciated. For high power propulsion and cruising speeds of 150 mph and over, the efficient quiet package will be in control.

No future large type of transport will be acceptable without such requirements, but it is impractical where we can put our hands on power. British equipment at the present time, but will make these needs.

Editor's Tutorial

The production problems of big and intricate made in comparatively small series have not received sufficient thought in the country.

A better break-down of the design for getting and testing them has been made, practice is necessary. When some general engineering testing that is not standard practice would speed up production.

Close understanding and appreciation of each other's problems between design and production from the early design stage would help considerably everything leads to be too radical and discredited because someone is over-zealous.

The production executive must know enough to be able to say when he can achieve production and he must be a sufficiently serious and balanced individual for his views to hold full on.

While working at Aircraft Advisory, NATCO, I had an American colleague, who had been production manager at a West Coast aircraft plant of over 15,000 hours for seven years and was well known for his all production problems. After being the British design, he was elected to the position of some of our production management.

For the class and quantity of modern aircraft production it is most important to pinpoint responsibility. A basic requirement is a definite principle of decentralization. Each supervisor must be the setup man and a clear-headed job.

Cost consciousness of all departments and at all levels is essential.

The delegation of responsibility, all the way down to the lowest level, at experience and the careful daily thinking in the supervisor can revolutionize a production plant. It is surprising to see that more accidents

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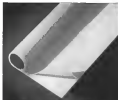
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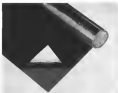
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ness is not given to such nation at high level.

For over 50 years I have been going round aircraft and engine factories in most parts of the world, and I am most grateful for the exposure this long apprenticeship has given me, in opening up the production approach of an organization. Two or three days' tour of any works I consider should enable a designer, thoroughly experienced production engineer, from outside the plant to estimate the possible production potential for at least the correct work on the lines of the shop.

The importance of a close watch on schedule, timing, and scheduling is crucial. It is not the obvious big things that count, but the little ones.

I am not impressed, if I see a job of dust-coated hinges, that production is in good shape. Mismanagement by exception is a valuable key to production.

That which stays on the schedule requires little attention; the exception are the things that want working.

Dormant Talent

Quality control, spot from inspection, nearly unobtainable is a great help.

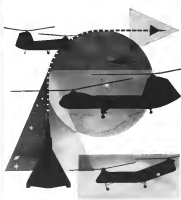
Enthusiasm and interest for the application of all practical modern techniques are important among the super-vent staff, and good understanding of the work, and the work itself.

A modern aircraft is a specialized, detailed, complex structure, and it will not put arms on date by the old shop methods. It wants a new approach. We possess the right talent in this, but in so many cases it is being dormant, and it requires time and leadership to bring it out.

Apart from these vital questions of adequate facilities and civil transport opportunities, the means the aircraft is beginning to take up in the air industry broadly is a definite "crisis" and is a measure of our ability and creative genius in a crisis.

In fact, it is realized that it will be impossible to remain a great nation as lead in the industrial and mechanical world without a country's research in design is not efficient and up-to-date. The present value is inestimable, apart from the air transport field, and efforts even the export market of more machine things such as tools and working machines. As usual, and as usual, it is to do with it, long, long the imagination of the youth of the world, in the same way that the British Navy and the American Marine did at the end of the last century, in the time of successful, producing the usual kinds of navy of our best-known commodities.

Lord Hibbins said, in a recent speech on "Stock-taking on the Research Front," that commercial engineering



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possibly use your gift, your Future is checked by circumstance and time is lost that can never be regained.

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• Utilization of research facilities operated by Plasco Corp., England, is being for establishment of a new company, Plasco Research Ltd. Chairman and managing director of new firm is A. C. Clark.

• New \$2.5-million plant for cold rolling aluminum sheet and intensive strip to thinner gauges than previously handled by Crucible Steel Company of America will be installed by the firm of its Millard, Pa., works. Completion is scheduled for 1957.

• Finishing of industrial tubing sleeves, nothing in 500-ft. section at which has been disclosed by Chance Vought, Inc., Dallas. Firm's tubing personnel designed hydrostatic and pressure-operated machines to protect the MS21918 or equivalent sleeve on other sections that subject to time-scheduled aluminum tubing. Engineers are also studying use of a new double ended sleeve and short unit to use weight and provide higher fatigue properties. First model will be on the 1/16-in. diameter tube used on a gas charging line.

• High-alloy and superalloy steel capacity of 500,000 lb. against monthly is remarkable increase, various research projects is planned by Allcochem Industries Steel Corp., Pittsburgh, Pa. Project will double the firm's current capacity of these metals.

• Muller-Sturges Titanium Corp. has opened new Pacific Coast office at 1415 N. Highland Ave., Hollywood, Calif., to better serve its recent customers in that area.

• Motorola Corp., division of General Electric Corp., has acquired larger quarters near a Glenview, Calif., plant to provide additional production and research and development facilities for silicon electronics.

• New general office building will be finished late this year for North American Airlines Inc. on Imperial High way at 9114 Sepulveda Blvd., Corning about 53 million the structure will contain about 141,000 sq. ft. of office space for the executive, payroll, accounting and public relations departments.

• Reinhold Corp. has moved into new \$200,000 plant in Levenshew, Ill. Firm makes corrosion and machine-resistant and laminates for the electrical and electronics industries.

yesterday...

today...



and...



Yesterday — in the expensive airplane phase of our progress — you built two decades to the middle 1940s, when American was widely known for production the famous "Curtis" airplane. As World War II advanced, American expanded the production of military aircraft and transport planes. During the war, Lockheed advanced technology to build the fuselage section of the mighty B-37 Flying Fortress. Before the war ended, Lockheed had produced more than 350 sections worth of material for the world's largest.

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Circuit breakers



AVIONICS

Arinc Tests Pinpoint Major Cause Of Avionic Equipment Failures

By Philip J. Klein

Tube failures may be blamed by as much as 50% on normal voltage levels. 27.5-volt d.c. power systems, if tube heaters are operated at their rated 6.3 volts instead of the actual, used 6.9 volts.

This conclusion is based upon two year tests on a number of AN/ARC-27 UHF transceivers conducted by Aeronautical Radio, Inc., under Navy sponsorship.

The tests revealed that modified ARC-27's whose tube heaters were operated at 6.5 volts operated 87% longer between malfunctions than did other standard ARC-27's whose heaters were operated at the customary 6.9 volts.

Voltage vs. Longevity

It comes as no surprise to aviation equipment designers that excessive tube heater voltage shortens tube life.

In de-powered aircraft, avionics equipment tube heaters usually are operated from d.c. in order to minimize the consumption of ac power, which is provided by less efficient inverters, and to save the weight of heater supply transformers.

When four tube heaters are connected in a series string across the d.c. line, approximately 6.9 volts (27.5 divided by 4) is applied to each tube—heaters 10% over its rated voltage. A dropping resistor could be inserted in series with the heater string to lower each heater voltage to 6.5 volts when the supply is at 27.5 v.

But if, under emergency conditions, the supply voltage falls to 20 or 22 volts, the heater voltage becomes too low for proper operation of the equipment.

Service Test Comparison

The objectives of the Arinc tests were two:

- To determine the effect of reduced heater voltage on tube life and equipment reliability.
- To compare the effect of reduced voltage on standard JAN tubes with its effect on the newer improved (suggested) tubes.

For Arinc's tests 40 sets of ARC-27's were divided into two equal groups by a random selection process. One group of 20, the "experimental group," was modified by inserting dropping resistors to reduce heater voltage to

6.5 v. when the shop's supply was at its center value of 27.5 v. d.c. The other 20 sets—the "control group"—were unmodified.

Assignment of standard and new improved tube types was made at random, except that none of each type, none used in every set. Also, the tubes used in each group's socket (i.e., line of amplifier, radio amplifier, etc.) were divided equally between the two tube types in the 40 sets. This was done so no difference in tube life between the two groups of equipment would reflect modification and not the difference between individual sockets.

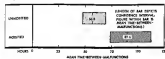
The 40 ARC-27's thus were installed in aircraft at the Naval Airborne Air Station, Chula Vista, Tex., and used in normal operations until failure. When a malfunction occurred, the set was removed and sent to a control repair shop.

By inserting a 3 Ohm dropping resistor in series with the ARC-27 heater circuit, all tube heaters were operated at approximately 110% under their normal voltage in the modified sets, with one exception—a pair of 2C79A power amplifier tubes used in the transmitters.

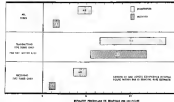
In standard ARC-27's, a series dropping resistor is used to lower the voltage applied to the 2C79A heaters to 5.5 volts. When the heater string dropping resistor was added in the Arinc modification, the voltage on the 2C79A's dropped to 5.2 volts—too low for satisfactory operation.

To get the 2C79A heater voltage back up to 5.5 volts in the modified ARC-27's would have involved a more modification, so Arinc decided to merely short out the original dropping resistor (in series with the 2C79A's), with the result that the 2C79A's and all other tubes would be operated at 6.5 volts in the modified sets.

Thus, in the modified sets, the 2C79A's were operating at a heater voltage about 9% above that in the



MEAN TIME-BETWEEN-MALFUNCTIONS FOR UNMODIFIED AND MODIFIED ARC-27 EQUIPMENTS AT CHULAVISTA, WITH 95% CONFIDENCE INTERVALS



ESTIMATED MEAN TIME BETWEEN MALFUNCTIONS (MTBF) FOR UNMODIFIED AND MODIFIED ARC-27 EQUIPMENTS

COMPARISON OF TIME between malfunctions (top) and tube life (below) in ARC-27 transmitters whose tube heaters operate at 6.9 volts and modified sets whose tube heaters operate at 6.5 volts.

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regular (passive) sets, while all other tubes were operating at a lower heater voltage than in the regular sets.

Test Results

After a total of 14,478 hours of operating time on the 40 sets, averaging 372 hours per component, Arco's data revealed the following:

- Mean time between equipment malfunctions was 30.6 hours for modified ABC-25 compared to only 16.8 hours between failures on the unmodified sets.
- Estimated annual rate for all tube types was only 1.153 per 100 hours in modified ABC-25, compared to 4.55 in standard sets.

The reduction in failure rate is even more pronounced when the figures are broken down between receiving and transmitting types.

- Receiving-type tubes 1.075 per 100 hours (modified) versus 4.55 (unmodified).
- Transmitting-type tubes 8.49 per 100 hours (modified) versus 10.05 (unmodified).

The higher failure rate for transmitting tubes reflects the fact the JCPAs on the modified equipment were, at times, operating above their normal heater voltage. That one tube type accounted for nearly 75% of all tube failures.

Big Pay-off in Some Types

A breakdown of tube life by tube type shows that the improvement resulting from reduced heater voltage runs as high as 90%. For example, 16ABC failures were cut 90%.

Although these data can yet have suffered failures of various types of tubes to provide a statistically reliable sample, the available data suggests that reduced heater voltage has a comparable effect on life of the more popular tube types.

Designer's Dilemma

Arco recognizes that the present design practice of operating tube heaters at 6.9 instead of 6.3 volts is due to radiator space which require that low resistance equipment be able to operate when the ship's supply voltage has dropped as low as 24 volts.

Obviously a tube lighter trying to make an emergency landing with its engine (and d.c. generator) out, is in dire need of radio communications. Yet at such time the aircraft's battery is at its sole source of power and battery voltage is quickly pulled down.

Then the milities and marine equipment designers face a dilemma: Arco's tests indicate use can run on undecoded unmodulated radiators and reduced tube failures, but only by sacrificing equipment performance under emergency (low voltage) conditions.

Although the Arco report does not suggest how the dilemma should be resolved a third alternative suggests itself.

If, in addition to adding heater string dropping resistors, a voltage-sensitive relay with reliable dropout characteristic is added, the tube heaters could operate at approximately their rated voltage, until the ship's supply voltage dropped below 24 volts. At such time, the voltage-sensitive relay would drop out, shorting out the dropping resistor, and placing the heater string directly across the ship's supply.

Arco's Radio Electronic Engineering Committee (RETC) has been in studying this possibility for use in airborne electronic equipment for years until the war years.

Amplifier Boosts Light 10,000-10,000 Times

A radically new type amplifier that can intensify light reflected from dark lighted objects by a factor of 10,000 to 10,000 was unveiled last week in a demonstration by its developer, the Free Instrument Division of Bendix Aviation.

The device, which could have many military applications in night radar, communications and warfare (as well as in medical X-ray and microscopy), is essentially a closed-circuit television system with a camera and cathode ray tube display.

The first demonstration featured a jet engine in a large basin in front of a Luminac camera. The area was completely blacked out except for a small "red" light approximately 250 ft from the subject. Despite the fact that the lenses are, could hardly discern the jet's silhouette, but later appeared. The Luminac's viewing screen with detail and clarity comparable to that of commercial TV on a home receiver.

The Luminac can be used to amplify any form of radiation capable of being converted into visible light. This fact is often reported. They were lighted, however, on details of jet from the Luminac operator, except to say that it was a conventional image intensifier in the camera and that the amplification is accomplished "with electronic circuitry."

Bendix officials also declined to discuss the Luminac's military possibilities but indicated that the military services are very much interested in the development.

One interesting characteristic of the Luminac, which may be a by-product to the type of amplification circuit employed, was observed during the demonstration. As the system gain was increased (through the adjustment settings), and a series of the camera picture would

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Output Linear and nonlinear functions of applied pressure.
Resolutions: 180 to 50,000 elms.
Ranges: 0-5 to 0-2000 psi
Types: Absolute and differential.
Vibration: Airframe: 8 to 15 cps, 3 to 500 cps and severe vibration 20g to 2000 cps.
Connectors: Hermetically sealed.
Write for Pressure Operated Positioners Bulletin



■ ULTRA-SENSITIVE PRESSURE SYSTEM

Output: 50 volts at full scale.
Range: 2-6 psi differential.
Resolutions: 1 x 10⁻¹ psi
Linearity: Better than 1 x 10⁻⁴ psi

Write for Bulletin #740



■ RESISTANCE BRIDGE PRESSURE MODULE

Output: 5 mV's at full scale
Range: 0-10 to 0-5000 psi.
Types: Absolute and differential.
Connectors: Hermetically sealed

Write for Bulletin No. 7



■ RATE OF TURN

Output: 5 volt output and/or dual indicator
Range: 0-25,000 R/hr
Time constant: 0.2 sec. as low as 1 to 2 sec. at 30,000 R/hr

Write for Vertical Speed Transducer Bulletin



■ RESISTANCE TRANSDUCER

Resolutions: 5 to 100 elms at 32°F
Materials: Platinum or nickel
Range: -150 to +2000°F
Types: Liquid, surface, gas
Characteristics: Corrosion, proof, severe vibration, overload, fast speed of response

Write for Resistance Transducer Bulletin

"For Transducers See Trans-Sonic"

Trans-Sonics, Inc.

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usually "work out" instead of the gradual "work out" experienced with a TV receiver. This characteristic was not unlike that experienced in smaller radar equipped with receiver converter use accuracy in the gain is increased.

The Lincen system uses 1,600 bits per picture instead of the 525 used in commercial TV, but the same bandwidth of 30 per second is employed.

Expansions, Changes In Avionics Industry

General Electric has recently entered the industrial computer field with the formation of an Industrial Computer Section at its Electronic Division headquarters in Syracuse, N. Y.

The move is intended to put GE in a better position for aggressively promoting and marketing a full line of computers including analog, digital, and simulation. The corporate unit, GE's discrete computer activities will be centralized in the new section under H. R. Oldfield, Jr., general manager. K. R. Carter has been named manager of engineering. C. C. Lisher is manager of marketing.

North American Aviation will build a new 557,000-sq-ft headquarters building for its recently formed Aerospace Division (AV Dec. 12, 1965, p. 46) in Downers, Calif., an Imperial Avenue between Arvin and Clark Aves.

The new 700,000-sq-ft building will house Aerospace Division administration offices, research and development and some manufacturing facilities. When completed next fall the new division will occupy a total of 900,000 sq. ft.

Other recent expansion within the aerospace industry include:

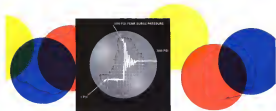
- **Aviation Electronics Co., Chicago**, has formed an Avionics Division to produce navigation indicators.
- **C. M. Gossens & Co., Inc., Reno**, Nev., Calif. has moved its Core Division to various quarters in Broadview.

Correspondence, however, should not be added to corporate offices of 915 First Coast St., Pasadena.

• **Minneapolis Honeywell's Instrumental Division** is constructing a 45,000-sq-ft addition to its present Minneapolis facility to house expanded research and engineering activities.

• **Kenneth Co., Inc.**, will construct new 240,000-sq-ft facility for its engineering and sales activities opposite present headquarters office and plant at Little Falls, N. J. When new facility is completed early in 1967, it will raise total floor space to 500,000 sq. ft.

• **North-Kittling Corp.**, New York, will replace the south, America, and name of Cinnabaration, Inc., Halesite, Long Island, producer of gyroscopes. Shale, Walcott, president of Gira-



Shudder shudder system shudder shudder



Shudder shudder system shudder shudder

CONTROL OF PRESSURE SURGE SHUDDER IN HYDRAULIC SYSTEMS

...WITH WESTON ANTI-SURGE VALVES

Pressure surges are normally the worst enemies of hydraulic systems. Specifications now limit surge pressures to 150% of the normal system pressure, but in many installations it has been difficult to achieve this limitation.

The solution to this problem is now being produced by Weston Hydraulics, whose

designers have designed anti-surge characteristics into the just patented 3-way and 4-way shutoff valves. This modification can be incorporated at no increase in weight and only a slight increase in cost. If you have pressure surge problems, our engineers will be happy to recommend the best configuration to meet your needs.

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There are many projects in guidance and control for North America's SM-65 Navaho Intercontinental Guided Missile. Projects in ingenious autopilots and fire-control systems for today's and tomorrow's ultrasonic manned aircraft. And many other projects equally exciting and challenging.

The tools at your command at Autonetics include the most advanced research and test facilities... latest digital and analog computers. You'll enjoy the professional recognition of working in this advanced atmosphere with leading scientists and engineers.

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mechanisms, will become general managers of the new Norden-Kitty division.

- **International Business Machines Corp.** has established a new independent research group "to develop business machines of the future." New group will be headed by Ralph L. Pilsner, former IBM director of engineering.
- **Viking Instruments, Inc.**, East Haddam, Conn., will build a new production facility at its present location.
- **Packard-Bell Co.**, Los Angeles, has purchased the assets of Technal Research, Inc., producer of printed circuits. New department will be under the direction of Richard B. Long, Packard-Bell vice president.
- **Acton Laboratories, Inc.**, Acton, Mass., maker of life test equipment has purchased the instrument division of Technology Instrument Corp., also located in Acton.
- **Hughes Aircraft Co.**, Culver City, Calif., has purchased a former Nash assembly plant at El Segundo, providing 500,000 sq. ft. of manufacturing and office space.
- **Aerodynamics Development Corp.**, Santa Monica, Calif., a subsidiary of Shadish-Parkland, is planning to build a million-dollar research facility in Santa Barbara.
- **Birdie Structures, Inc.** is name of new company formed by Walter W. Bird, and other former employees of General Aircraft Laboratories who developed the air-supported radome for air defense radar. Company will develop new applications for the technique. Address: 290 Linden St., Buffalo, N. Y.



► **Flight Radar Display Coming**—All three manufacturers of surface weather radar (Rendac, Colson, and RCA) are experimenting with bright tube displays employing storage-type tubes developed by Hughes Aircraft, Fairchild or RCA.

► **Airborne Teletype Evaluation**—Flight tests on airborne teletype for use by North Atlantic air carrier (AW) June 13, 1955, p. 76), to handle weather reports and weather information, are slated to begin shortly. The evaluation, sponsored by Norel, an informal organization of North Atlantic airline operators, is code-named "Norel." One ground station will be located at Falmouth, Nova Scotia, the other in Britain.

► **Spangco to Produce SB Transducer**—Pulse Corp. has licensed Spangco Electric to produce its surface barrier transducer, providing a new source for the high-frequency device. Spangco

8 OF THE 15 'MILLION MILER' SAFETY AWARDS IN 1955 WENT TO PILOTS FLYING AIRWORK OVERHAULED ENGINES

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1 **LANDING GEARS**—Nose and main landing gears on many of today's fighter fighters are built by CPT, using experience and high alloy steel.



2 **ACTUATORS**—High force, landing gears, and rubber door actuators act landing gears are operated by CPT ball-bearing mechanisms and pistons.



3 **FIN PLATES**—High strength, lightweight fin plates are made by CPT using the world's largest flash-burn welder for assembly.

production will begin this summer. The company also is carrying out its own semi-conductor research and development program.

► **Flare-Out Adapter Tests**—Machef's Airlines will soon begin serial phase of its flight test work on an improved model of the automatic flare-out adapter, AN/APN-71 (XA 4), developed by Hamilton Electronics Corp.

► **New Automation Handbook**—Suro-Woodbridge Corp. is sponsoring the preparation of a new three-volume series entitled "Handbook of Automation, Computation and Control." Approximately 20 universities and industrial firms are participating in the project.

► **New Midwest Computing Facilities**—Cook Research Laboratories, St. Louis, a division of Cook Electric Co., has established a computing and data reduction service facility, available on a contract basis. Facility, which includes both digital and analog computers, is described in Bulletin N-16.

► **Arise Eyes Scatter Communications**—Aeromarine Radio, Inc., has obtained authorization from Federal Communications Commission for a possible future scatter-communication type, audio, radio-type link between Miami and Puerto Rico. Immediate implementation is not intended.

► **Major Airborne Teletype**—A light-weight (57 lb.) airborne teletype which reportedly can be tied easily into existing IFF or VHF communication sets will be announced soon. Teletype was developed by Bell & Gossett, Morton Grove, Ill.

NEW AVIONIC PRODUCTS

Components and Devices

► **Delux** line, Model S1P4, bipolar constant type, for pulse coding and decoding circuits, is tapped every 2 microseconds. Total delay time is 200 microseconds, with rise time of 1 μ s. Afterdrive reportedly is under 12 μ s with an 8 μ s pulse. Temperature coefficient is less than 40 ppm/Deg. C. Lattin Industries, Components Div., 136 Ne-Futrell Road, Beverly Hills, Calif., or 215 S. Foothill Ave., Mt. Vernon, N. Y.

► **Miniature relays**, Series G, for space- and/or high shock and vibration at temperatures up to 125C, measure 10x14x14 in. Units are hermetically sealed, come in DIPDT style, with contacts rated 5 amp at 28 v, d.c. Oper-

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Write Office: 127 E. Pennsylvania, Detroit, Mich.
Representative: Bendix International, Inc., 333 E. 55th St., New York 22, N. Y.



ing voltages up to 75 v. d.c. are available. Gage Electrical Measuring Co., 1729 West 134th St., Golden, Colo.

• Miniature d.c. voltage divider with three adjustment sections and four output terminals is completely encapsulated and can be operated at temperatures of -50C to 125C. Unit measures 1 in. in dia. x 1 in. long, is available



with up to 100,000 ohms per section, wound to accuracy of 1%. Power rating is 1 watt at room temperature, 1 watt at 175C. Dymo Co., 310 West Mt. Pleasant Ave., Livingston, N. J.

• Miniature precision zero-resistor pot, type AP-5, is now available in 10,000 and 100,000 ohm values, 2 watt rating



at 50C, with 2% linearity. Catalog sheets are available on request. Wilson Manufacturing, Inc., P. O. Box 368, Seaford, Minn.

• Miniature electrical heater and switches in variety of sizes and ratings range, with operating voltages from 0 to 120 v. d.c., for use in servo and



instrument systems are now available from A. I. Thompson Co., Route 1, Box 637, Pleasant, Mo.

• Miniature miniature potentiometer, Model RVG-17528, may be operated at speeds up to 60 rpm. Standard resistance is 10,000 ohms, but other resistances between 4,000 and 10,000 ohms are available. Angular and amplitude accuracy is quoted at 1%. Unit measures 1 1/2 in. in dia. x 2 1/2 in. long including shaft. General Co., Newton Upper Falls, Mass.

Microwave Devices

• Microwave pulse magnetron for operation at 75 kw. are designed for short pulse operation in radar or missile applications. Model MA-200 is rated at 40 kw peak power, while



the MA-206 is rated at 30 kw. Both units are lead framed. RF spectrum of the magnetrons reportedly is unchanged under 15G vibration at 1,000 cps. Microwave Associates, Inc., 22 Cambridge St., Boston, Mass.

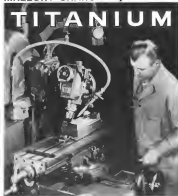
• Load relays are a new family of closed units designed especially for remote weather radar, microwave data acquisition and remote guidance. Units provide up to 30 db isolation, with currents less than 1 db. Item Model relay rated at 50 to 65 kw.



at average power levels up to 500 watts and peak power up to 1 megawatt. Lofco Industries, Components Div., 135 N. Fourth Rd., Booths Hill, Calif., or 215 So. Tullock Ave., Mt. View, Calif.

• Traveling-wave tube amplifier, Type MA-11, covers frequency range of 2 to 4 kw. and reportedly has a noise

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• Mallory-Sharon now guarantees that MST titanium and titanium alloy mill products contain no more than 1/10 of 1% carbon, maximum. These larger percentages of carbon result in formation of hard carbides which greatly reduce machinability, this guarantee assures you that MST material has the optimum machining characteristics obtainable.

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Ten years ago this degree of power did not exist... but the future of our nation's guided missile programs demanded it.

So when the Rocketdyne Division of North American Aviation, Inc., was given the task of creating such engines, they had to start practically from scratch. This meant new designs—including improved cooling methods and manufacturing techniques—that permitted temperatures greater than blast-furnace heat inside the

engine, yet kept the outside cool enough to touch.

Engineers studied available fuels so that engine designs could extract maximum energy from every gallon. This called for new pumps—and turbines to drive them. Turbines, more powerful than 10 auto engines yet smaller than a car battery, were built. The completed engines, tested at Rocketdyne's propulsion field laboratory in the nearby Santa Monica Mountains, have passed the

ragged requirements of space flight.

This 10-year backlog of experience in all phases of rocket engine development and manufacture has made Rocketdyne the leading supplier of large, liquid-propellant rocket engines to our Armed Services and the guided missile industry.

Rocketdyne will welcome inquiries from engineers interested in this new field. Write Rocketdyne, Personnel Manager, Dept. W-1, 4650 Canoga Ave., Canoga Park, California.

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BUILDERS OF POWER FOR OUTER SPACE

A Division of
North American Aviation, Inc.

Epave of only 12 to 15 db over the band. Device has a 30-35 db gain, and more than 10 mw output. Higgins Laboratories, Inc., 711 Hamilton Ave., Menlo Park, Calif.

• Waveguide detector, Model 508, for use in the K band reportedly has 100 mw VSWR, less than 1.5. Unit operates over frequency range of 12.4



to 18.0 kw and can be used for absolute or relative power measurement. Nucleo Corp., Menlo Park, N.Y.

• Scattering phase shifter, Type IN230, reportedly can handle several watts more to only 74 db. Device is designed for X-band server test. Microwave Laboratories, Inc., Beverly Hills.

Instrumentation

• FM identifying transceiver, Model 7581, crystal-controlled, weighs only 26 oz and occupies 40 cu. in. Unit puts out 1 watt of RF power, more than carrier frequency within 0.001% and has a frequency response flat to within 14 db between 100 cps and



180 kc. A 5-watt output produces 125 kv. deviation, and maximum modulation distortion is quoted as .75%. Modulation factor says that 10G vibration between 20 and 5,000 cps produces less than 500 cycles deviation within the 800 spectrum. Temperature variation of -40C to 87C, especially, results in frequency shift of less than 1 ppm deg. C. Ralph M. Parsons Co., 155 West Dayton St., Pasadena 2, Calif.

Communications

Equipment

• VHF receiver, Type 51M5 single-channel AM receiver for aviation ground station use covers the frequency band of 165 to 182 mc. Receiver has mechanical filter to provide 80 db rejection of adjacent channel signals, also pro-

The "Carcano" thermocouples to be used to measure temperatures for evaluation of efficiency and safety of the "Seawolf" reactor require heavy stainless steel shields and Coronal Alupro thermocouple wires.



T-E's NEW "Carcano" THERMOCOUPLES WILL BE USED TO CHECK REACTOR TEMPERATURES ON ATOMIC SUB "SEAWOLF."

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Get all the latest information on these new metal-clad, ceramic-insulated wires and thermocouples. Write for Bulletin 31-300C.

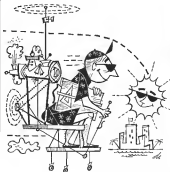


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video amplifier is a four channel, switchable channel and stereo amplifier. Collins Radio Co., Cedar Rapids, Iowa.

• **Mobile receiver, Model 5**, operating in the 24 to 30 mc. band, is crystal controlled, provides 24 with audio output and has a sensitivity of one micro-



volt. Device measures 4 1/2 x 7 1/2 in., weighs 7 1/2 lb., and operates from 6 to 12 v. d.c. West Coast Electronics Co., 1875 Rader Rd., Los Angeles 16, Calif.

Data Processing Equipment

• **Digital-to-analog decoder, Model 100C**, is an all-electronic converter which can accept up to 100,000 ten-bit binary codes per second, with a precision of 0.1%. A similar unit with identical speed and precision is available for binary coded decimal conversion. Linear-to-decimal drift reportedly is less than 0.5%. Converter also has an associated a Model 101D analog-to-digital converter, which can make conversion at a rate of up to 15,000 ten-bit codes per second, also with a 0.1% precision.

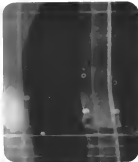


ACF Electronics, Dept. 224, 500 No. Pitt St., Alexandria, Va.

• **Decimal-to-binary converter** changes a four-digit decimal number punched on a manual keyboard into 14 straight binary digits. A keyboard indicator actuates the established number until a "clear" button is pushed. Provision for establishing plus or minus sign is included. Device operates from 115 v., 60 cycle power. It measures 10 1/2 x 14 1/2 x 10 in. Raycon-Coroll Inc., Inc., 85 Hunt St., Glen Cove, N. Y.



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Thrust gage design is this Boeing engineer's "baby"

From launch to landing, the project was a flying one near a nonsupporting. The assignment—to design an engine mount that will sustain from other loads and measure within 1% of 1% the instantaneous in-flight thrust of a guided missile.

The mission called a thrust gage, that is, engine and airframe without modification of them, and used "pure" equally in all directions during a temperature rise of several hundred degrees in less than a minute. The object of a thrust gage engine mount with less than half the weight of the present one.

It was in typical of the challenges and creative assignments given Boeing engineers. There are more than 6,000 of them—mechanical, civil, electrical, structural and materials engineers, and mathematicians and physicists (and more engineers of all kinds are needed).

The engineer is finishing his report with the preliminary sketch before him. Next, he will support drawings and engineering analysis of final design. Then he will work closely with other engineers in production, structural testing, stress, vibration and tolerancing. During this thrust gage test his responsibility error growth, and a real sense of professional achievement.

Boeing engineers have career stability in a steadily growing company that now employs more than twice as many as when it was at the peak of World War II. Boeing is planning for them in the progressive, comfortable career opportunities of Seattle and Wichita.

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B-52, and the Boeing B-43, "hardcore" of Strategic Air Command. There's a new working job waiting you now at Boeing in design, research or production.

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Boeing Airplane Co., Dept. C-1 Seattle 14, Wash.
R. J. McFARLANE, Development Engineer
Boeing Airplane Co., Dept. C-46, Wichita, Kansas

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SAFETY

CAB Report on Stratocruiser Hitting Fence

Prop Reverse Circuits Were 'Off'

A Boeing 707, N 74001, owned by North West Airlines, Inc., and operated as Flight 415, went through the airport boundary fence beyond the last end of runway 11L after landing on that runway at Chicago Midway Airport on August 1, 1965, at 11:11 P.M. No injuries were sustained by the passengers or crew. The aircraft was seriously damaged.

Flight 415 originated at Minneapolis-Moline, with the destination Chicago, Ill. The departure was from Minneapolis-St. Paul International Airport at 11:10 as an LRV (last runway) flight. The flight plan which designated a light to be made via Victor Airway 25, Victor Airway 57, and Red Airway 26, at a crossing altitude of 15,000 feet.

The crew consisted of Captain George A. Shaw, First Officer Ralph T. Gray, Flight Engineer Hiram L. Curtis, Flight Engineer E. S. Lunde (Headquarters), Stewardesses Helen K. Kennedy and Louise Hadden, and Flight Service Attendants Michael D. Leahy and Paul Williams. There were 60 passengers on board.

According to company records the gross weight of the aircraft at the time of impact was 145,750 pounds and the load was properly distributed. The maximum gross weight allowed was 150,770 pounds.

When the flight reported over Lincoln, Wisconsin, ARTCC (Air Route Traffic Control Center) was notified to descend and cross the Wilson Lake VORTAC (VHF Omnidirectional Range) at 5,340 feet. The 80% clearance was calculated by the pilot shortly after passing Wilson Lake. At 17:10 local frequency was changed to Midway tower and the flight was then advised to impact west of the field on a left hand to impact on runway 11L.

Geos Through Fence

Flight 415 was member down to land in a reverse circuit of the runway. Touch down was about 100 feet short of the runway, and the landing roll continued to the end of the runway without appreciable deceleration. At the end of the runway a light house in the left was made and the aircraft crossed several hundred feet of grass area before crossing through the chain link fence bordering the airport.

The aircraft impacted against the landing end, with its nose landing gear on the pavement of Central Avenue, the front landing gear on the end of the runway. The aircraft and crew left the aircraft on the runway, and the aircraft was towed to the base of the tower for investigation.

Chicago Midway Airport located at the time of the accident was 16,000 feet below clouds, reported at 25,000 feet, visibility 10 miles, wind force 8 knots. Data for the period 1800 to 1930 hours had been received from the tower.

At the time of the accident the weather was clear with visibility 10 miles, wind force 8 knots, and the aircraft was on the runway. The aircraft was towed to the base of the tower for investigation.

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international light was shown (08 miles), however, the runway marker was dry at the time Flight 415 landed.

INVESTIGATION

It was determined from the photographs of the aircraft wreckage and statements of the crew, that a touchdown had been made in the intersection of runways 51L and 11B. The location is approximately 1,400 feet beyond the approved end of runway 11L, which is 6,415 feet long. The first detachable landing gear of N 74001 on the runway was approximately 1,000 feet beyond the point of touchdown. These marks were light in character and extended on the runway for approximately 800 feet.

The next 800 feet of runway reflected light on the landing action, and the last 800 feet of runway at the end of runway 11L could not be seen by the aircraft. The runway across the 200 feet of grass area leading to the boundary fence.

The structure of crew testimony in that aircraft was approximately 19 knots. Following touchdown brakes were applied lightly.

No Prop Reversal

When the throttles were moved into the reverse position forward thrust was experienced. When reversed the captain put the throttles into the forward after position, called the aircraft to reverse drag, and after getting no indication from the aircraft, turned, full and continuous application of the emergency brakes.

The report stated that the aircraft was on the left at the end of the runway and could not be seen by the aircraft. The aircraft was towed to the base of the tower for investigation.

All crew members were on the aircraft at the time of the accident. The aircraft was towed to the base of the tower for investigation.

Captain Shaw stated that he felt the aircraft was reversing after the aircraft had been reversibly in reverse position. The aircraft was towed to the base of the tower for investigation.

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ing of the accident, controllers stated that had been evidence of pilots reporting poor visibility when two previous flights high and the runway was not in use.

The flight manual for N 74001 aircraft and crew state that with a gross weight of 115,000 pounds the approximate landing speed of Chicago Flight 415, land speed of 11 knots and temperature of 15 degrees. The aircraft should have been in a normal landing with a 10-foot obstacle using normal braking, and without the use of propeller reverse. The maximum runway length under these conditions is 1,700 feet.

Aircraft Damage

The aircraft received considerable structural damage. A majority of the blades of all four propellers were damaged by contact with the fence. The No. 1 engine mount was damaged to an extent requiring replacement of the powerplant. The last two of the main gear indicated heavy landing action as evidenced by large shroud pins extending outward through the wing. The wing fence and the wing were moved damage from contact with the fence.

The left side of the fuselage was dented from the top down to the "cove" line by the wing of the steel fence which became entangled in the propeller in the aircraft passed through the fence. The right side of the fuselage received lesser damage in the same manner. Contact with a steel landing pole indicated the main gear side of the left wing.

Cockpit windows were cracked shortly after the accident occurred. No one other than the pilot, the following "Normal" brake system pressure 1,100 psi, artificial normal results "off", the reverse control "outboard and inboard" manual levers on the outboard side of the fuselage were "off" or "out" levers on the panel were "off".

The deaccelerating flight engineer, who had been in the cockpit at the time of the accident, was not behind the engine at the time of the landing. Captain Shaw stated that he felt the aircraft was reversing after the aircraft had been reversibly in reverse position. The aircraft was towed to the base of the tower for investigation.

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SAFETY

wt and 11 inches wide. The forward bulk contains the engine control switches, landing button, reverse engine operation and aircraft lighting switches. The rear bulk of the panel has five separate rows of approximately 21 control buttons each.

The other three control breakers are located in the rear row, eight from the left side and the two reversing control breakers are located in the fourth row, from the rear, at the approximate center of the row. The two standard control breakers are immediately aft of the popular reversing control engine breakers. All control breakers can be reached from any of the three rows.

Following the accident the aircraft was returned to a larger airfield.

Strategic repairs were made and No. 1 powerplant was replaced before actual testing of the landing and propeller reversing system.

Ground investigation

On August 10, four-hour tests of these items were performed at Midway Airport. A preliminary ground check revealed the following checks: Magneto, propeller reversing and manual feathering. No discrepancies were noted and the aircraft was then turned over to the flight test crew.

After testing, in which there were several effective applications of emergency brakes, thorough engine cleanup was made. Through this cleanup a check was made of valve feathering, manual feathering and propeller

reversing with manual results.

The two reversing control circuit breakers were then pulled and a check was made of engine rpm on the forward side and reverse side throttle quadrant. This test revealed the reverse side rpm to be from 550 to 750 higher than forward side rpm on all engines.

The captain and first officer stated that forward thrust was experienced when the throttles were moved past the idler into the reverse quadrant. Forward thrust is obtained when the throttles are moved into the reverse quadrant at the reversing control circuit breaker set "off" at the start of the throttle movement and remains "on" while the throttles are in the reverse range.

Three accelerated stoppage tests were made, in which the aircraft speed reached 75 to 100 knots. During the first two normal landings were made with the standard brake turned off; the second run was with the standard on; the third run had propeller reversing only. In all three runs normal braking and deceleration was obtained.

No malfunctions

On August 12 the aircraft was ferried by the Northwest Overland Bus, St. Paul, Minnesota. Thorough checks were also made on the electrical systems and propeller doors and no malfunctioning was found.

The reversing control circuit breaker being in the "off" position does not prevent the moving of the throttle back into the reverse quadrant and the increase of engine power at that position, but it does deactivate the propeller control circuit in associated with reversing. When the propeller blades would remain in forward pitch producing forward thrust. When the three other control breakers in a "off" throttle locking circuit prevents the throttles from going forward past the idler detent.

The Northwest Airlines Supervisor of Flight Engineers stated that the aircraft had been used the day of the accident for a captain's proficiency check and that he acted in flight engineer on that flight. His brother-in-law testified that during the landing and at the last flight, one or more of the engines stalled in the air. As a corrective action, and possibly both, of the propeller reversing control circuit breakers had been pulled and were in that position (off) when he left the aircraft a short time before the case of Flight 410 took over.

It was explained that a number of incidents had been experienced when propeller blades moved to the standard position while, owing, and of course on landing, due to a malfunction in the signal circuit.

Such an action in "idle" angle is accompanied by an increase in propeller load that tends to stall the engine. Meanwhile, the auxiliary pump motor temperature is caused while, owing, and of course on landing, due to a malfunction in the signal circuit. Such an action in "idle" angle is accompanied by an increase in propeller load that tends to stall the engine. Meanwhile, the auxiliary pump motor temperature is caused while, owing, and of course on landing, due to a malfunction in the signal circuit.

The flight engineers of Flight 410 testified that he had made a thorough preflight inspection of the aircraft at Minneapolis, including checking the reversing control circuit breakers for "on" position. However,

Altitude tests, high and low temperature checked

Send and dust detector



Reversible ground test detector



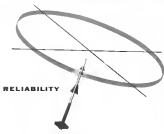
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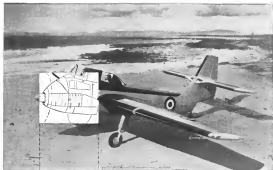
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Sand strip - Seamew base



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Seamew—a tough, economical, all-weather submarine hunter. Airborne in a short distance from any rapidly constructed strip—or even a stretch of beach—the Seamew can conduct a maritime search with up-to-date radar equipment and use a variety of weapons to effect a kill. Its high manoeuvrability, low stalling speed and fixed shock absorbing undercarriage enable the Seamew to land back safely after operating in weather conditions impossible for other anti-submarine aircraft.

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Greater lift surface contributes to the very low stalling and landing speeds. The Seamew requires the minimum length of runway in emergency strip or sand carrier deck.



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SAFETY

indicated that he fully intended to use it in view of the subject landing.

Since the propeller reversing circuit breakers were found in the "out" position and so this can be the sole reason why propeller reversing could not be effected in this instance, it is apparent that they were not thoroughly checked during the pre-flight check at Minneapolis or the pre-landing check at Chicago.

The Board concludes that the "out" position of the reversing circuit breakers was the only reason to account for the accident's inability to obtain reversing when the aircraft was moved into the reverse position.

FINDINGS

On the basis of all available evidence the Board finds that:

1 The company, the aircraft and the crew were carefully maintained.

2 The aircraft was properly loaded with respect to gross weight and location of its center of gravity.

3 The flight between Minneapolis and Chicago was routine and in good weather.

4 The structure, groundplane, propeller, landing gear, and electrical systems were found to be capable of normal operation.

5 The propeller did not reverse when the thrust reverser was moved into the reverse position.

6 After the accident the correct location of the propeller reversing system were found to be the "out" or inoperative position which precluded propeller reversing.

7 Evidence indicates that the propeller reversing circuit breakers were pulled during a prior flight at Minneapolis and were not reset prior to the accident.

PROBABLE CAUSE

The Board determines that the probable cause of the accident was the inability of the pilot to stop the aircraft by means of conventional braking and the unavailability of propeller reversing due to the improper position of the reversing circuit breakers.

By the Civil Aeronautics Board:

Earl R. Rife
Joseph F. Malone
Clara Conway
Harold D. Dewey

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident at approximately 1305 August 5, 1959. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (1) of the Civil Aeronautics Act of 1958 as amended.

A ground investigation was conducted by the Board and witnesses were taken at Chicago, Illinois, on September 15, 1959, at Minneapolis, Minnesota, on September 19, 1959, and at Washington, D. C., on September 22, 1959.

Air Carrier

Norfolk Airlines, Inc., is incorporated in the State of Minnesota and maintains its principal place of business at Minneapolis, Minnesota.

The company possesses a certificate of public convenience and necessity issued by the Civil Aeronautics Board and is at present operating outposts owned by the

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BOA.C. will introduce the Comet 4 into world service in 1959.

DE HAVILLAND of GREAT BRITAIN

TCA Cargo Gains

TransCanada Airlines carried 1975 more cargo in 1955 than in 1954, a total of 15,217,198 lb. TCA also reports that it carried more freight between Canada and Great Britain via the North Atlantic than any other carrier—more 1,049,492 lb., or 30% from 1954.

North American Loses Atlantic Service Bid

Washington—North American Airlines' request for authority to operate a cabotage, Atlantic service across the North Atlantic has been turned down by the Civil Aeronautics Board.

The CAB refused to grant the authority asked by North American without a careful examination of the structure. The merchandise airline wanted an auxiliary, evacuation authority to start its proposed service.

This does not mean that we believe that there is no room for improvement in the quantity or quality of such services by the regular carriers or that service has already achieved the optimum level of Atlantic, the Board said. Consideration of new services frequently comes in a wake to the improvement of services in existing carriers.

The position of the CAB is that to force additional scheduled coach competition in a jet on Atlantic routes, an existing carrier process should be followed to avoid jeopardizing existing services. The Board said that the proposed service could have been reaching emergency and should be approved through its own process under without public hearing or presidential approval.

North American also has asked for a certificate of public convenience and necessity for the proposed service. The Board observed that the question of passenger operations by the new supplemental air carriers on overseas routes was considered in the Large Liner Study. In its decision, the Board decided such service was not needed.

Remembered of North American's asking authority was cited as a factor which raises questions on the fitness of the airline to operate the service. The CAB wanted North American's authority but manner, and the matter is currently being reviewed by the U. S. Court of Appeals.

The service proposed by North American would have offered aircraft flights on high density transatlantic routes at fares substantially lower than present coach fares. The airline asked for an exemption to operate these flights a day for a three year experimental period between New York and London, Paris, Frankfurt and Rome.

The Department of Marine and Aviation is still satisfactorily opposed to the North American's request despite CAA's official pronouncement. CAA's own statement, O'Connor claims the freight freight is the better use for aviation government money and safety.

O'Connor contends that the "balding blades" of the NYA helicopters

N.Y. City Plans Heliport Hearing As CAA Backs Authority's Plan

New York—Proposals for a permanent heliport in Manhattan seemed to brighten last week as Mayor Robert F. Wagner announced he would call a special meeting of New York's Board of Estimate to decide the controversy between the Department of Marine and Aviation and the Port of New York Authority over the heliport plans (ENR Jan. 9, p. 105).

The service's announcement followed the filing of a letter, addressed to Port Authority Chairman Donald V. Lowe, in which Civil Aeronautics Administrator Charles Jones endorsed the Port Authority's proposed "landmark" heliport at the foot of West 15th Street. The Authority's plan, Lowe concluded, was suitable for "a safe and reasonable regular passenger operation" by \$15 helicopters as passenger-lifters.

On Commissioner of Marine and Aviation William O'Connor's proposal for a million dollar coastal flight terminal located at the same location, Lowe wrote: "we do not believe that a passenger operation from the proposed rail-to-helicopter is feasible or safe" with either short-type gear or passenger stairs.

Order with the use of steel piers, gear, which would be a severe penalty in weight, could the rail-to-helicopter be certified by CAA, Lowe said.

For their forthcoming immediate construction of the Port Authority's \$50,000 helicopter heliport, Commissioner O'Connor attacked the Authority for releasing the Lowe letter, he called the move an attempt to belabor the issue.

On the helicopter port, however, he said that New York City will not accept a conventional heliport, which even an agency is negatively worded, until the City and the Port Authority get together on plans for the city. Neither agency can operate a waterfront heliport without the other agency.

O'Connor welcomed the mayor's announcement of an early Board of Estimate hearing on the controversy, and was "confident" that he would win his case. The Port Authority had no comment on the announcement pending further developments.

The Department of Marine and Aviation is still satisfactorily opposed to the Port Authority's request despite CAA's official pronouncement. CAA's own statement, O'Connor claims the freight freight is the better use for aviation government money and safety.

O'Connor contends that the "balding blades" of the NYA helicopters

world threaten aircraft along the West Side Highway, and the sight of helicopters using river craft would plague their men and lead to accidents.

The Port Authority and New York Aeronautics point out that, under the Authority's plan, the helicopter could be using rivercraft approaches and stay well clear of the highway.

Marine and Aviation thinks its plan is good once in view of the weight placed by the CAA approval leading for the rail-to-helicopter would involve.

Congress Asked to Ban Jets at City Airports

Washington—Legislation to prohibit ground transport from the landings and takeoffs of high-speed jet aircraft by banning these operations from coastal airports located within the home zones of a city was introduced by Rep. Albert Bosch (R-N. Y.).

Bosch's bill would have the airport or airports "prohibited" in whole or in part by jet operations or so from an airport located within a particular within the boundaries of any city having a population of one million individuals or more.

Two other measures introduced by Bosch would increase the visibility standards at airports and impose coastal penalties for jet safety violations, now subject only to civil penalties. Bosch's bill would require certification of aircraft with more than two engines from 300 ft. to 600 ft. and for aircraft with one or two engines from 400 ft. to 1,300 ft.

Meanwhile, Rep. Albert Moore (R-Calif.) declared that Air Force and Navy jets are not only breaking the sound barrier but are breaking up a lot of houses throughout the country, and he would demand the Services Committee to take action to protect home owners from jet shock waves.

Bosch pointed out in a speech on the House floor aviation accidents caused by limited conditions at New York, N. Y., airport, located at its congested second district. He said:

"On Dec. 18, 1954 an Boeing DC-68 airliner roared low over houses and densely populated areas in the vicinity of Idlewild airport, not once, but three times, and finally on a fourth approach ripped into a junction box, burst into flames and sank in the water—the toll 25 persons killed. It is not hard to imagine just this plane, out of the fog, could just as easily have hit and crashed into houses..."

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Flying rescues—one mile down in Hell's Canyon

"Roughest terrain in the country"—that's what most pilots call the 5500 foot-deep Hell's Canyon of the Snake River. But every winter George Foster of Grangeville, Idaho, makes several emergency flights to isolated ranches inside the canyon's narrow gorges and lifts accident victims out to hospitals for medical aid.

"The land is all straight up and down, inside the canyon rim," says Mr. Foster. "Flying between thousand foot cliffs calls for plenty of attention and for lots of power when I need it, too. But I always get the extra power I have to have,

with Cessna Avionics Gasoline 40/70 in my Super Cub. Cessna 40/70 never fails to give me, delivers smooth, dependable performance. I can lean it down for economy in level flight, too.

Because nearly all of my flying is over wilderness, I can't risk any engine trouble. However, I've had such complete success with RPM Avionics OI that I don't even need top coaches before my flights. RPM's and valves are in perfect condition right up to the last hour in the air. I'll never use any oil but RPM in any plane I own."

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TIP OF THE MONTH

It's wise to stay away from the backwash of large aircraft of any kind, extreme turbulence often exists more than 4 miles in these weeks.



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Shortlines

► **Airlines Choosing Home** needed airline business worth \$13,700,165 in December, 11.7% more than was handled in the previous December.

► **Canadian Pacific Airlines** has resumed its Toronto-Mexico City service to two flights a week. CPA has taken delivery on the first of four DC-48 aircraft scheduled for delivery this year. The new equipment will be used on routes between Amsterdam, Vancouver and Mexico, and between Toronto and Mexico City.

► **Control Airlines** has suspended its new service to St. Louis with four flights daily to Vancouver, Ft. Smith, McAlister, Paso, Sherman, Denton, Del Rio and Ft. Worth.

► **Delta Air Lines** begins service to Wilmington and New York from Atlanta with an initial schedule of three flights a day. The new service includes a DC-7 first class flight and DC-7 and DC-6 coach flights.

► **Fera and Spaul** have signed an agreement to operate the Spanish Airlines route to Los Angeles under terms of the new agreement.

► **Siberia City Airways** has made a slight fare cut on its service across the Irish Sea. SCA plans to double its present service for the coming tourist season.

► **Titan World Airlines** will accept the engine overhaul and fuel oil in its new, Kawan City bus this spring. A new engine is scheduled for completion later this year. TWA started service at Denver with one first class and tourist flights daily. New service of Titan and Goldenrod City begins with four flights a day.

► **United Airlines** will conduct and machine parts will lead the company's new line in total weight carried. Car, Brown, electrical equipment, auto parts and accessories, painted rather, wrong apparel, handbags, alcohol parts and accessories. Size and substructure matter complete the list of top tips.

► **Vasoviet** will build a second airport 17 miles from the downtown area at White Rock, British Columbia, to divert light plane and executive traffic from Vancouver's large international airport.



SCALE MODEL of New York International Airport "terminal city" development before completed buildings, detailed roadway, parking lot layouts. Port Authority says the \$30,000, 12 by 41 ft. model is no "fancy display" piece but a valuable tool for architects and planners and has already more than paid for itself in design momentum.

Port Authority Defends Idlewild Planning Criticized by N.Y. Mayor

New York—Reacting to Mayor Robert F. Wagner's charge that the terminal facilities at New York International Airport are "a disgrace to New York and the whole United States," the Port of New York Authority last week unveiled a great model of its new "terminal city" now under construction at Idlewild and reviewed its multi-million-dollar plan for the airport.

Mayor Wagner made his blast at a Young Democratic Club meeting, but

later toned it down somewhat and said "adequate" would be a better way to describe the Idlewild facilities.

Calling criticism of the "terminal city" terminal unveiled in 1949 from the City of New York, preposterous, Port Authority Director Austin Tobin admitted "we don't like it either," and God knows the passengers want to be out of it. "He pointed out that plans for the new \$60 million passenger facility had been announced in Feb. 1955, the first construction contract had been let 30 days later and the major buildings would be in operation in 1957 to provide the New York metropolitan area with "the most modern and efficient terminal facilities available anywhere."

City Threat

Later in the week, Gov. George F. LaGuardia Jr. crossed the Port Authority's position, as "a major danger" and threatened to consider suing the authority unless a specific date was set for completion of airport improvements.

Crosses claimed delays and broken promises in the Port Authority's effort to develop Idlewild and LaGuardia airports, and he attacked the development of facilities private enterprise as expert.

LaGuardia Rehabilitation

The Port of New York Authority is "over anxious and ready to go ahead with a major rehabilitation of LaGuardia Airport," Austin Tobin, the agency's executive director, said last week.

"Frankly discussing" their financing plan a program was under way with an eye toward the field, according to Tobin. LaGuardia, he pointed out, "will never suit" — will keep it about "and suit off the end of the report is making at a rate of three miles a year. Rebuilding of the perimeter dike and other construction maintenance programs for this service. "We need LaGuardia," Tobin at length.

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Airline Income and Expenses—November, 1955

	Passenger Revenue	Mail Revenue	Express Revenue	Freight Revenue	Schedule	Total Operating Income	Total Operating Expenses	Net Operating Income (Before taxes)
DOMESTIC								
American	\$17,164,932	\$506,470	\$388,444	\$1,303,855		\$18,363,601	\$11,997,699	\$6,365,902
Boeing	3,495,090	78,375	46,415	45,598		3,619,480	2,084,908	1,534,572
Capital	3,573,996	92,739	105,618	111,813		3,773,166	2,184,784	1,588,382
Central	448,499	1,818	3,808	15,309	\$81,770	540,204	366,608	173,596
Continental	5,134,340	21,613	11,743	25,548	146,081	5,319,285	3,180,353	2,138,932
Delta	4,071,580	170,116	84,363	152,785		4,478,844	2,416,550	2,062,294
Eastern	12,581,299	354,346	308,806	261,544		13,506,001	7,855,000	5,651,001
National	2,026,162	123,021	24,816	40,240		2,214,245	1,314,811	900,434
Northwest	552,451	1,455	538	1,568	150,875	706,329	428,828	277,501
Northwest	3,029,684	154,157	78,738	178,899		3,341,478	1,853,858	1,487,620
TWA World	11,350,880	241,834	320,843	638,371		12,551,938	7,003,238	5,548,700
Western	14,112,759	282,995	437,303	571,444		15,404,501	9,275,589	6,128,912
Woods	2,693,456	78,613	31,263	38,584		2,841,916	1,583,536	1,258,380
INTERNATIONAL								
American	385,120	15,859	15,859	42,538		420,476	248,248	172,228
Boeing	274,423	115,845		21,871		388,888	248,323	140,565
Capital	79,453	1,399	4,431	1,431		85,714	51,502	34,212
Columbia Atlantic	57,071	40	8,106	4,318		65,455	41,803	23,652
Delta	591,180	6,500	18,423	15,465		625,168	325,348	300,820
Eastern	175,170	30,000	15,465	15,465		216,100	119,907	96,193
National	280,356	5,338	1,504	18,773		305,968	174,864	131,104
Northwest	879,831	339,878	4,837	24,757		1,224,503	678,344	546,159
Northwest	910,000	16,200	34,800	111,000		1,052,000	600,000	452,000
Alaska	5,000,000	870,000	650,000	1,310,000		7,430,000	3,790,000	3,640,000
Alaska	3,482,000	516,000	460,000	1,310,000		5,768,000	3,180,000	2,588,000
Latin America	3,482,000	516,000	460,000	1,310,000		5,768,000	3,180,000	2,588,000
France	1,087,446	70,406	22,780	4,581		1,185,213	644,873	540,340
San World	3,157,081	148,024	333,187	11,707		3,649,000	2,116,371	1,532,629
United	680,807	34,337	11,707			726,851	346,815	380,036
LOCAL SERVICE								
Allegany	971,873	7,871	5,345	130,725		1,015,014	498,973	516,041
Boston	197,348	8,303	1,738	8,789		208,178	114,084	94,094
Central	76,192	3,421	8,051	2,988		80,652	44,154	36,498
France	175,302	268,875	5,651	36,888		420,616	237,439	183,177
Lake Central	86,518	5,214	8,015	10,876		110,623	52,418	58,205
Marshall	383,000	3,118	2,700	5,011		393,829	203,361	190,468
North Coast	214,278	13,810	18,165	158,703		364,956	194,387	170,569
Oriskany	120,535	176,813	3,066			290,414	154,402	136,012
Piedmont	346,700	8,219	4,432	7,338		366,689	203,871	162,818
San Francisco	136,910	6,815	4,735	7,301		155,761	82,124	73,637
Seattle	175,454	6,412	5,712	3,021		190,600	108,036	82,564
West Coast	714,470	9,498	9,498	30,318		743,786	401,384	342,402
West Coast	146,272	2,898	1,420	8,337		158,927	81,791	77,136
HAWAIIAN								
Honolulu	976,340	3,013	52,738	10,821		1,042,912	426,747	616,165
San Francisco	118,518	740	5,300	4,100		130,666	156,954	-26,288
CAROL LINES								
American Southern			208,081			208,081	118,110	90,000
Florida			115,084			115,084	1,081,127	-966,043
Florida			915,031			915,031	595,991	319,040
St. Paul			245,023			245,023	194,991	50,032
HELICOPTER								
New York Airways	11,873	8,448	2,340	2,359		13,620	148,214	-134,594
Los Angeles Airways	3,676	12,474	6,713	14,019		23,882	84,940	-61,058
Helicopter Air Service		38,007				38,007	37,001	1,006

Compiled by Aviation Week from data reports in Civil Aviation Board

Write Mr. Joe Roberts, Rocketdyne Engineering Personnel Dept. 5860 Canoga Ave., Canoga Park, California.

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COCKPIT VIEWPOINT

By Capt. R. C. Robson



Close Shave on the Ground

Airport traffic control is one of the most complex operations in aviation. The people in the tower must coordinate safe separation between aircraft of various sizes, wings, aircraft on the ground, helicopters and literally hundreds of service vehicles. We run an efficient operation—particularly when several accidents are in the air—such as a landing clearance is a horrendous task.

Occasionally there comes to light a particularly keen operator which shows some of the possibilities at the larger airports. One such close shave occurred back in November. It was shortly after dark on a clear night when an efficient Lockheed landed on Runway 11 at one of our major terminals.

The tower used the usual advice to make a right turn and contact ground control on 121.9 mcs. Immediately after the turn, an outgoing Controller called south for takeoff on the same frequency. Before clearing the Center, it was necessary for the tower operator to short turn in order to check on the progress of a DC-6 approaching from the south.

Seeing that there would be ample time to get the Controller off, a clearance was issued by the operator while he was turning back toward the field.

Confused Pilot

All this action took but a few seconds but caused the loss of the tower controller when, upon focusing on the "live" runway again, he saw the Center's heavy down on the same Lockheed which had presumably been cleared the runway. As luck would have it the Lockheed had a complete radio failure at the instant of turning clear of the runway. The pilot began confusion with the report because confused, he said later, he was of CAA's local dispatch agent and thought he had made a wrong turn. Thereupon he immediately did a 180 and turned back onto Runway 11B. Several things are evident from this episode. First, the pilot of the Lockheed was wrong, terribly and stupidly, wrong, to return to the active runway. Second, the pilot of the Controller should have been more alert to the conditions of the runway, they were about to see. Third, the tower should have cleared the runway before issuing a takeoff clearance. But let us not be too hardy about doing the blame. We will always have "recessed" Lockheed's who are unfamiliar with large airports. We will always have transports in a haze for takeoff and cleared with numerous outside clocks. And it will always be necessary for tower controllers to face the risks we, as pilots, face. In the day as well as night, control, tower, tower of wisdom outside these things are heavily associated.

Ground Direction Signs

But this does not mean that all is lost—there are some things that can be done. First the signs. Back on Sept. 1, 1953, the existing standard for the tower controllers of signs at the CAA. Basically, they are too small and use too many abbreviations. The good old plain English type, found at Boston, are still best. In addition to signs, a system of red and green, stop-and-go traffic lights is needed to assist the controller in the clear time of ground traffic. Perhaps we should also add signs which screen danger lanes. Runways—De Not Lanes in large, single old letters. It might also be mentioned that perhaps aircraft qualifications should be required for pilots flying into major terminal areas (this subject is so covered here on Nov. 30, 1953).

So far, to say that conditions like this are personally going to happen one way or another. The picture of two flying worlds in the center of an airport is not a pleasant one. Some steps can and should be taken for that problem of ground direction is but another phase of this total air traffic story.

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A Survey of Euclidean Cases and Algebraic Conones

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THE BORTHP
AIRCRAFT AND POWER PLANT
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I started out in 1965, after I finished a year at the U.S. Air Force Academy. I had a commission, but my primary interest was in the military. I was working in the U.S. Air Force, and I was involved in the U.S. Air Force, and I was involved in the U.S. Air Force.

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LETTERS

Pilot Training Fund

Strong and some interesting red letters appear on sides, and military pilot and ground personnel drawings. I did come pulled to sit down some of our own personal thoughts on the subject.

Overall, and across other staff members of one institution, devote considerable time and effort to the learning of some staff roles, methods and concepts. We completely cannot see C-A-R methodology, acquisition immediately following completion of the short-term course, or an entire course in Terms of Access and Impact and C-A-R. Interest in this, class, has been most satisfactory and we intend to continue on various medical subjects in detail.

However, as the lower and steeper the

We cannot possibly remove parents' federal responsibility, to be a sufficient amount of an awarded salary to keep them interested enough to continue their training at a certified flight school. Our squadron has a scholarship sponsored by USAF, master classes of Wichita, but that is so little for us more doubtful.

What is really needed, all over the country, is the establishment of a fund for the purpose of financing the young men and women of America in various subjects. The fund should be the responsibility of the Federal Government; the U. S. military or home and foreign affairs, the state government, local area or social groups.

The Civil Air Patrol can be very instrumental in the training of large numbers of ground and flight personnel who, when this become of age will be available to military and civilian phases of aerospace activities.

The considerable foresight of our government in setting up NACIO, should be followed through at home. The Civil Air Patrol is needed for civil defense, disaster relief, air search and rescue, and most importantly, to induct and train the young men and women of America in all phases of aviation.

Financial support by the families and local working members of the Civil Air Patrol who gladly donate their time and experience, will assist in providing uniformed members of interested and trained personnel for military and civilian aviation.

A. E. GORDON
Engineering Office
Civil Air Patrol
Squadron No. 1
Wichita, Kansas

M-Day Effort

We have a great deal about the planning that has been and is currently being done regarding Air Force Production Reserve Program, and other Mobilization Div. proposals.

Sixty planes in el campo volador

Autumn Week celebrates the epiphany of its readers as the names suggest in the magazine's editorial calendar. *Autumn Weeks* to the Editor, *Autumn Week*, 320 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine introduction. We will not print anonymous letters, but names of writers will be withheld on request.

and naturally occurs, but one must not get all too theoretical. Why, and it would like to address my question to the AI players, do they not at least specify a specific temperature and create a full set of data, about creating a particular type of compound?

For example, on some old data (known only to themselves) tell the person supplier of 4-47 just exactly as some other comparable, rational, sensible place in order for an "N" number of such to maximize (best possible) delivery of new mass effect.

This type of sign is suggested for use though it is well as its use to place priority, if it still experimental and would be the start of an actual emergency (hazardous, for instance) in all probability still be used.

It is not clear that such a "technical" it could be called that would be expensive, but I think it will be agreed that it would be money well spent on such a technical product as could be made and it would give some indication of the state of the world in relation to the world economy.

hours etc., and with those cannot be served production at a point of time when traffic demand here, the stored a rather close supply. It would not milk, in the location of TMS center, but road

get the All-planet's money directly from them. Factor which might possibly be proposed to many other types of one another.

H. A. Priest,
Burlington, Vermont

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and tunneling, and units of measurement and their interrelationships in the process of determining basic configurations or aerodynamic profiles, performance, and flow characteristics; static and dynamic loads and the strength requirements necessary to meet such loads.

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Lightplane Approach

For instance, a Green 140 can easily come to a position at 170 km/h and should I down the entry, cut the power and land in 1b, but third spacing traffic all the way around.

It is indeed frustrating reading, tailored to leading clinicians, as a highlander makes a 70 mph straight-on approach down two sides out.

E. D. Winters
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Boulder, Colorado

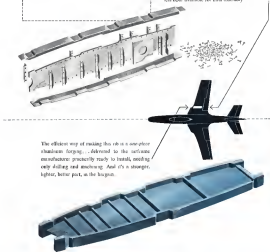
Investigate CAA

I heartily agree with you that the CVA should be investigated.

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Eddie Rickenbacker

Chairman of the Board, EASTERN AIR LINES

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